CITY OF ANGELS CAMP

Community-Wide and Government Operations

2018 GREENHOUSE GAS EMISSIONS INVENTORIES

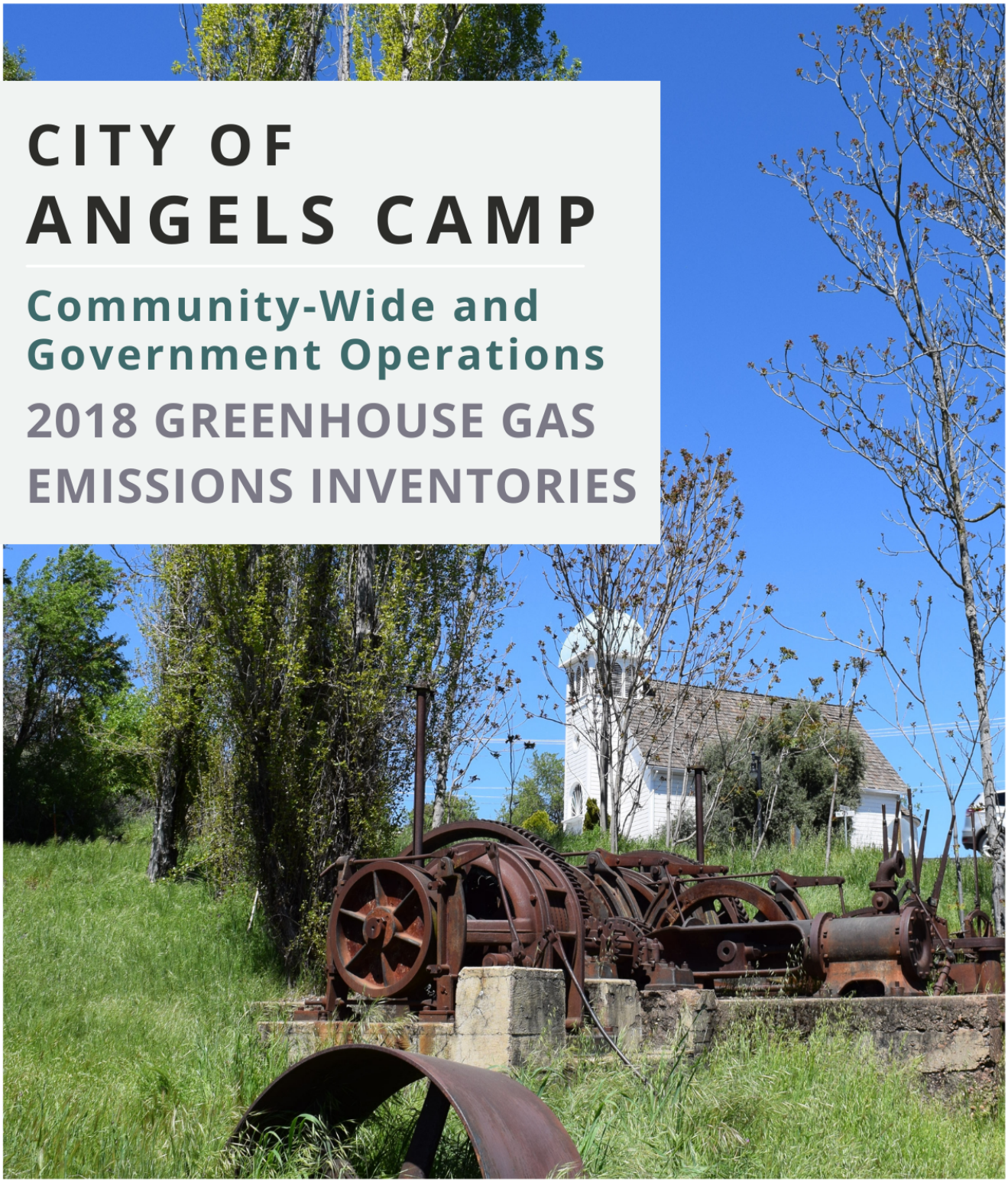

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Table of Contents

Tables & Figures

Executive Summary

The City of Angels Camp (City) is addressing reducing greenhouse gas (GHG) emissions by taking climate planning action. This report serves as a guidepost to local GHG emissions reduction efforts, including future development of the City's GHG Reduction Plan that will address emissions resulting from energy use[1], transportation, solid waste disposal, treatment and transport of potable water and wastewater. Through these planning efforts, the City can achieve benefits beyond reducing emissions, including saving money – both community members' and the City's, improving economic vitality, public health, and the quality of life for residents and other community members.

This project has been split into two phases. Phase I establishes a replicable methodology for analyzing current and projected GHG emissions, develops a baseline measurement to benchmark progress over time, and proposes initial reduction targets. Phase II of this project includes developing emissions reduction plans outlining strategies, goals, and priority actions to reduce emissions consistent with state requirements, as well as communicating progress to the public, stakeholders, and policymakers. These actions will help to implement the City's General Plan goals, air quality goals, facilitate new development, and other compliance issues related to GHG emissions reductions.

This report documents the results of community-wide and government operations GHG emissions inventories from sources within the City in 2018. Community-wide activities resulted in the emissions of 25,193 metric tons of carbon dioxide equivalent (MT CO_2e), which equates to a per capita emissions value of 6.46 MT CO_2e per year. City government operations generated 511 MT CO_2e. Key findings from each inventory are listed below. More detailed discussion of each inventory is provided in the **Community-Wide Inventory Results** and the **Government Operations Inventory Results** sections.

In addition, the inventory projects the City's GHG emissions from 2018 out to 2045, based on a business-as-usual (BAU) forecast and an adjusted scenario forecast (ABAU) of community-wide GHG emissions[2]. The 2045 forecasts project an increase for the BAU scenario and a decrease for the ABAU scenario from the 2018 baseline. Under the BAU scenario, emissions are projected to increase by 12.7%, equating to 28,378 MT CO_2e projected to be emitted in 2045. Under the ABAU scenario, emissions are projected to

[1] As of the published date of this report, the specific impacts of Public Safety Power Shutoff (PSPS) events on GHG emissions in Calaveras County are unknown. The first PSPS event took place in 2019, which is after the baseline year of 2018 used for this report. As energy sector data from 2019 and on becomes available, this can be used for future inventories and re-inventories of community-wide and government operations GHG emissions.

[2] Note: this does not include forecasting projections for wildfire.

decrease by 28.0%, equating to 18,133 MT CO_2e projected to be emitted in 2045. The report also includes emissions reduction target recommendations for the City to consider. More detailed information is provided in the **Emissions Forecasting** and **GHG Reduction Targets** sections.

The Calaveras County and Angels Camp GHG inventories and reduction plans project also includes a wildfire report, a separate assessment that analyzes the carbon storage inventories for the County's and City's natural and working lands, potential GHG emissions impact from wildfires, climate change vulnerability assessment related to wildfire, and wildfire impact reduction best practices. The 2020 Calaveras County natural and working lands total carbon stock inventories was calculated to be 74 million MT CO_2e. In the unlikely scenario that the majority of the deciduous and mixed forests in Calaveras County were to burn over multiple future wildfire events, the forested land has an emissions potential of over 8 million MT CO_2 from the conversion of carbon stocks to atmospheric carbon. Forest management can reduce the intensity and severity of wildfires in Calaveras County, reducing the GHG emissions potential per acre of forested land from 21.7 MT CO_2/acre burned down to 9.3 MT CO_2/acre burned. The full wildfire report can be viewed in **Appendix O**, Wildfire-related Greenhouse Gas Emissions from Natural Lands Carbon Stock Loss and Climate Change Vulnerability Assessment.

With support from the Calaveras Council of Governments (CCOG) and guidance from City staff, Sierra Business Council (SBC), along with subconsultant team of Rincon Consultants and Harris & Associates, completed all emissions estimates in accordance with the United States Community Protocol[3] (USCP) and the Local Government Operations Protocol[4] (LGOP). Details on the inventory boundaries and the protocols can be found in the **Inventory Methodologies** section of this report.

Key Findings of the Community-Wide GHG Emissions Inventory

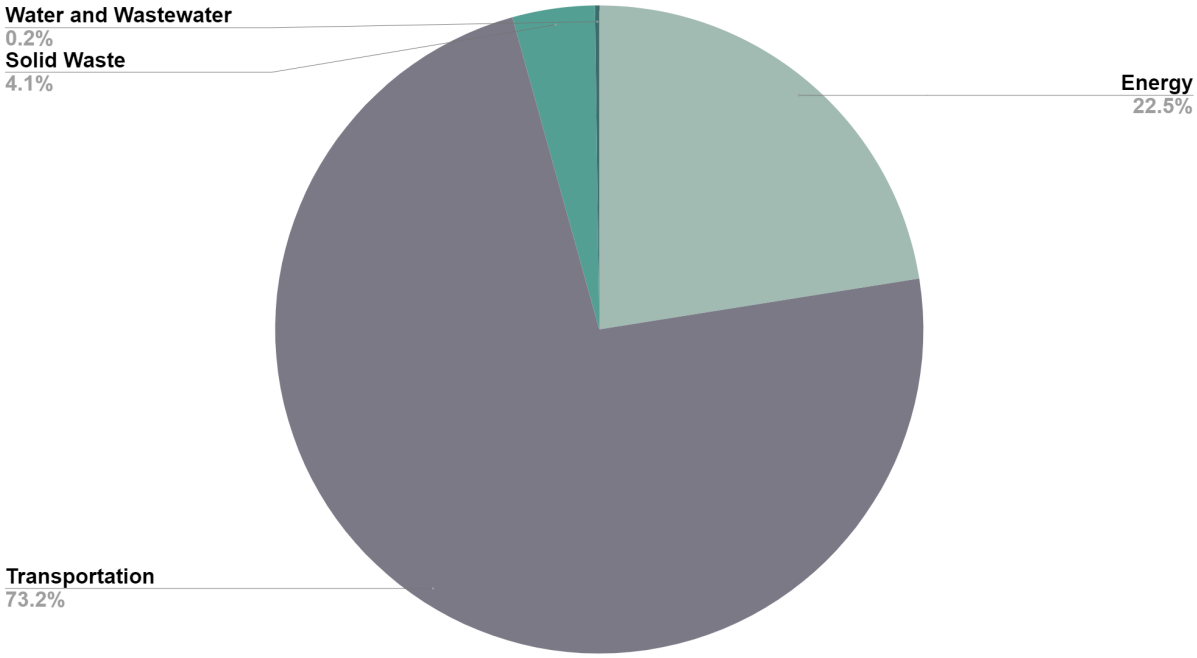
In 2018, sources within the City, and activities of the City's residents, businesses, and visitors emitted 25,193 MT CO_2e. These emissions are attributed to four different sectors: energy use, transportation, solid waste, and water and wastewater. The transportation sector was the most significant contributor of emissions. In summary:

- Transportation accounted for 73.2%

[3] U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (2021). ICLEI - Local Governments for Sustainability USA.
[4] Local Government Operations Protocol (2021). The Climate Registry.

- Energy use accounted for 22.5%
- Emissions from solid waste accounted for 4.1%
- Water and wastewater accounted for 0.2%

Figure ES-1: 2018 Emissions Summary

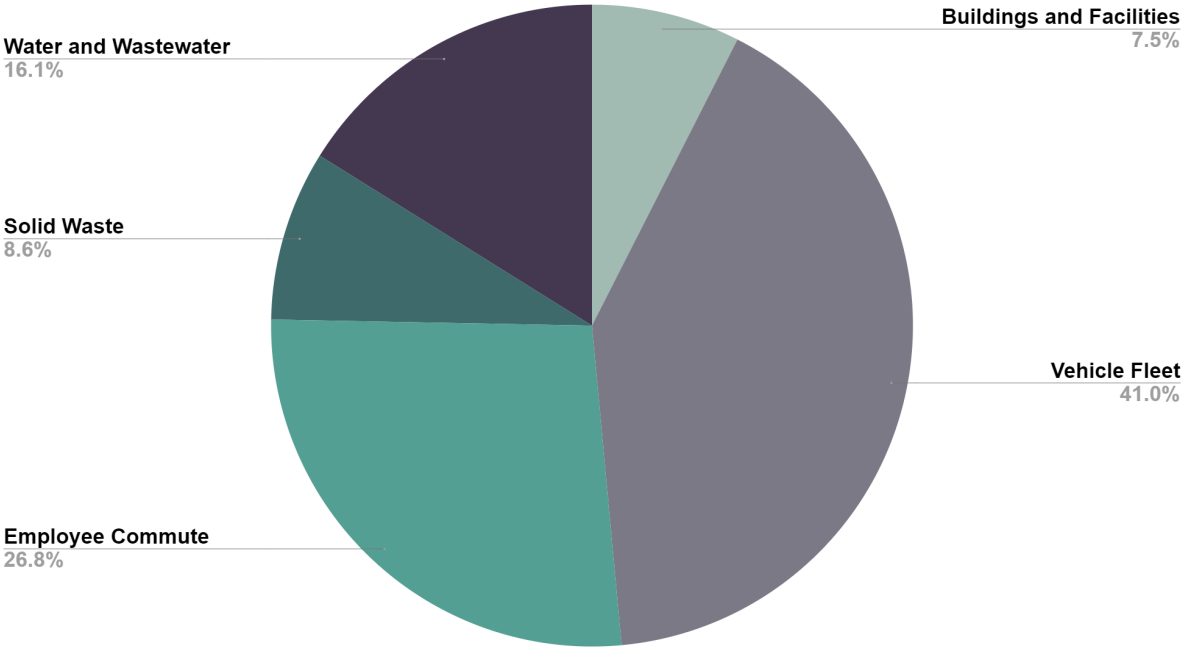


Key Findings of the Government Operations GHG Emissions Inventory

In 2018, City government operations generated 511 MT CO_2e for the sectors reported in this inventory. The vehicle fleet sector was the most significant contributor of emissions.

- Emissions from the City's vehicle fleet accounted for 41.0%
- Emissions from City employee commutes accounted for 26.8%
- City-owned and operated water and wastewater facilities accounted for 16.1%
- Emissions from City facility-generated solid waste accounted for 8.6%
- Energy from the City's buildings and facilities accounted for 7.5%

Figure ES-2: 2018 Emissions Summary



Introduction

California's legislature and regulatory agencies have established policies relating to greenhouse gas (GHG) emissions reductions, including the California Global Warming Solutions Act (AB 32, 2006) and others discussed in more detail in the **California Climate & Policy Goals** section of the report. Due to these drivers and other motivations, many of California's local governments and communities are quantifying and reducing their GHG emissions. The City of Angels Camp (City) has responded to California's climate action planning process by developing goals and policies for GHG emissions reductions in its 2020 General Plan Update and subsequently developing community-wide and government operations inventories for the year 2018 to implement those policies. This report documents the findings and methodologies of those inventories. With support from Calaveras Council of Governments (CCOG) and guidance from City staff, Sierra Business Council (SBC), along with the subconsultant team of Rincon Consultants and Harris & Associates, completed emissions estimates in accordance with the United States Community Protocol (USCP) and the Local Government Operations Protocol (LGOP). These protocols outline widely adopted and accepted methods for performing GHG inventories and are recommended by state agencies for local governments. More information on the inventory boundaries and the protocols used to develop the inventories is provided in the **Inventory Methodologies** section of the report.

GHG emissions are air pollutants as defined by the U.S. Supreme Court and subject to regulation by the U.S. Environmental Protection Agency under the federal Clean Air Act and the State of California under the Global Warming Solutions Act of 2006 (AB 32). These gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF_3). It is important to note that each of these gases has different potency, or ability to contribute to global warming. For the purposes of this inventory and in accordance with USCP and LGOP, all gases have been converted to their equivalent in carbon dioxide or CO_2e.

The City's inventory report presents a detailed accounting of GHGs emitted by source. In addition, the inventory projects the City's community-wide GHG emissions from 2018 to 2030, 2035, and 2045 based on business-as-usual (BAU) and adjusted scenario (ABAU) forecasts of changes in energy use, transportation, solid waste management, and wastewater treatment. These factors are influenced over time by changes in climate, population demographics, land-use and transportation patterns, the adoption of new technologies, and measures adopted to reduce GHG emissions.

This report is the first step toward measuring emissions reduction progress, planning future climate action, and developing strategies for reducing GHG emissions over time. The purpose of this report is to establish a baseline measurement or foundation to benchmark progress over time and guide City-wide climate planning and action. The second step of this process includes developing and prioritizing strategies to reduce GHG emissions consistent with state mandates, and involve and communicate progress to the public, stakeholders, and policymakers.

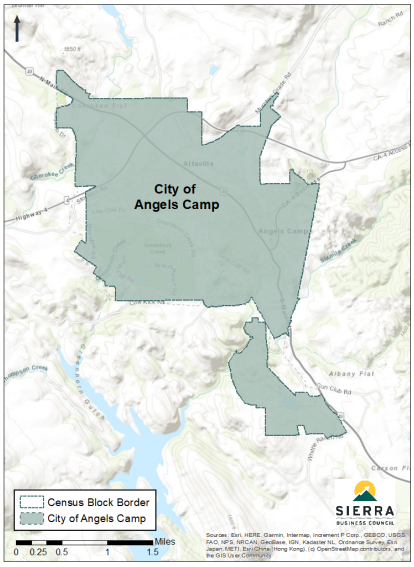
The first phase of the Calaveras County and Angels Camp GHG inventory and reduction plan project also included a comprehensive wildfire GHG analysis, designed to be consistent with the California Air Resources Board's "Report on Greenhouse Gas Emissions of Contemporary Wildfire, Prescribed Fire, and Forest Management Activities".

Rincon Consultants developed an in-depth analysis of the carbon sequestration value of wildlands and the fire emissions potential from these lands. The report includes an inventory of all the carbon sequestered in both the soils and vegetation of the County, including the City, to understand areas that have high carbon sequestration value, consistent with California's Natural and Working Lands Inventory. This will provide the City an understanding of the specific regions that would generate more GHG emissions and loss of vegetation carbon storage in a wildfire event. Furthermore, the wildfire assessment included an evaluation of areas that are likely to have a high fire return interval and overlap with these high carbon storage areas, and what the potential reduction in GHG emissions could be from forest management practices. The results of the report can be used to better understand the potential shifts in carbon stocks during wildfire events, and how forest management activities can reduce the loss of valuable carbon sequestration in the City's natural lands. The full report has been attached under **Appendix O**, Wildfire-related Greenhouse Gas Emissions from Natural Lands Carbon Stock Loss and Climate Change Vulnerability Assessment.

Community Profile

Located at 1,378 feet in elevation and home to approximately 4,000 residents, the City of Angels Camp is an iconic Gold Country town nestled in the Sierra Nevada foothills. It is well known as the place Samuel Clemens first heard the story and wrote "The Celebrated Jumping Frog of Calaveras County" giving rise to his fame as Mark Twain. Today, it is well loved for the Jumping Frog Jubilee and Calaveras County Fair, its gold rush history, high country recreation, local wineries, golf courses, and notable small town charm.

Originally inhabited by Indigenous Miwok people, Angels Camp was one of the earliest important mining communities along the Mother Lode region of California. Situated in southwestern County of Calaveras (County), on State Routes 49 and 4, it is traversed by Angels Creek, China Gulch, Greenhorn Creek, Cherokee Creek, Indian Creek, Six-Mile Creek, and several Gold-Rush era miner's ditches. Nearby is the New Melones Reservoir, which was created by the construction of the New Melones Dam in 1979 by the U.S. Army Corps of Engineers, replacing the original 1926 dam.



California Climate Policy & Goals

Since 2005, the State of California has responded to growing concerns over the effects of climate change by addressing emissions in the public and private sectors through legislative action. California mandates and guidance on measuring and reducing GHG emissions include:

- executive order on California global warming impacts and targets (EO S-3-05, 2005)[5],
- the California Global Warming Solutions Act (AB 32, 2006)[6] and its successor bill (SB 32, 2016)[7],
- the Sustainable Communities and Climate Protection Act (SB 375, 2008)[8],
- the California Clean Energy and Pollution Reduction Act (SB 350, 2015)[9],
- local government requirements for climate adaptation and resilience strategies (SB 379, 2015)[10],
- the California Air Resources Board (CARB) 2017 Climate Change Scoping Plan[11],
- the 100 Percent Clean Energy Act of 2018 (SB 100, 2018)[12], and
- executive order to achieve carbon neutrality (EO B-55-18, 2018).[13]

[5] http://static1.squarespace.com/static/549885d4e4b0ba0bff5dc695/t/54d7f1e0e4b0f0798cee3010/1423438304744/California+Executive+Order+S-3-05+(June+2005).pdf
[6] Global Warming Solutions Act of 2006 (AB 32). California Air Resources Board.
[7] Global Warming Solutions Act of 2006: Emissions Limit (SB 32). (2016). California Legislative Information.
[8] Transportation Planning: Travel Demand Models: Sustainable Communities Strategy: Environmental Review (SB 375). (2008). Institute for Local Government.
[9] Clean Energy and Pollution Reduction Act (SB 350). (2015). California Energy Commission.
[10] SB 379, Jackson. Land use: general plan: safety element (2015). California Legislative Information.
[11] https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/scoping_plan_2017.pdf
[12] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100
[13] https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf

All of the above legislation provides guidance and protocols for local governments to participate in the State's GHG reduction efforts.

In response, many communities in the United States are addressing emissions at the local level. California state climate policies and mandates both encourage and require local governments and public agencies to develop solutions at the local level. As many of the major sources of GHG emissions can be directly or indirectly controlled through local policies and actions, local governments have an opportunity to play a key role in reducing GHG emissions within their boundaries. Through proactive measures related to land use, transportation demand management, energy efficiency, green building, waste diversion, and more, local governments can contribute to emissions reductions in their communities. This GHG inventory will build capacity for the City to better understand and address local climate impacts, allowing them to set goals that will increase their resilience and comply with California's greater climate strategy and mandates.

Climate Change in the Sierra Nevada

The California Assembly Bill 32[14] defines climate change impacts under the following language: Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems. Global warming will have detrimental effects on some of California's largest industries, including agriculture, wine, tourism, winter sports, recreational and commercial fishing, and forestry. It will also increase the strain on electricity supplies necessary to meet the demand for summer air-conditioning in the hottest parts of the state.

The CARB 2017 Climate Change Scoping Plan[15] provides additional details on the specific threats of climate change, particularly relevant for rural, forested regions like the City. The CARB scoping plan states: In California, as in the rest of the world, climate change is contributing to an escalation of serious problems, including raging wildfires, coastal erosion, disruption of water supply, threats to agriculture, spread of insect-borne diseases, and continuing health threats from air pollution.

[14] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060AB32
[15] https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/scoping_plan_2017.pdf

- The drought that plagued California for years devastated the state's agricultural and rural communities, leaving some of them with no drinking water. In 2015 alone, the drought cost agriculture in the Central Valley an estimated $2.7 billion, and more than 20,000 jobs.
- Changes include: A recorded increase in annual average temperatures, as well as increases in daily minimum and maximum temperatures. An increase in the occurrence of extreme events, including heat waves. A decrease in winter chill hours, necessary for the production of high-value fruit and nut crops.
- In recent years, California has experienced the deadliest wildfires in its history.
- Extensive tree mortality is already prevalent in California. The western pine beetle and other bark beetles have killed a majority of the ponderosa pine in the foothills of the central and southern Sierra Nevada Mountains.
- California will experience a reduction in spring runoff volumes, as a result of declining snowpack.
- While more intense dry periods are anticipated under warmer conditions, extremes on the wet end of the spectrum are also expected to increase due to more frequent warm, wet atmospheric river events and a higher proportion of precipitation falling as rain instead of snow.
- In recent years, atmospheric rivers have also been recognized as the cause of the large majority of major floods.
- Climate change is making events, like these listed above, more frequent, more catastrophic and more costly. Climate change impacts all Californians, and the impacts are often disproportionately borne by the state's most vulnerable and disadvantaged populations.

These are the many challenges associated with climate change that face the City, along with communities in the Sierra Nevada. To learn more about how climate change might impact the City, state agencies in California created a new public tool, Cal-Adapt, which provides relevant data, resources, and future projections.[16] A healthy ecosystem provides cultural, social, and economic benefits that local communities rely on for agriculture, tourism, recreation, fishing, and other industries that are important to the City and its economic vitality.[17,18]

[16] Cal-Adapt. California Energy Commission. (2021).
[17] Core Writing Team, Pachauri, R.K., Meyer, L.A.. (2014). Climate Change 2014: Synthesis Report. Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
[18] Dettinger, M., Alpert, H., Battles, J., Kusel, J., Safford, H., Fougeres, D., Knight, C., Miller, L., Sawyer, S. (2018). Sierra Nevada Region Report. California's Fourth Climate Change Assessment.

Inventory Development

Aligning with established methodology and protocols, the inventory development process involved a number of key steps and decision-making points:

- **Identify Emissions Sources and Activities**: In consultation with CCOG and City staff, the team assessed 2018 GHG emissions from four different sectors: energy (energy use in buildings), transportation, solid waste, and water and wastewater. Within each sector, activities that occur in the City that release emissions outside of the City, as well as sources that generate emissions directly within the City, were accounted for. Emissions associated with government operations were also identified and included.
- **Inventory Boundaries**: The geographic scope of the inventory is referred to as "the City of Angels Camp" and is defined by the City's jurisdictional boundaries.
- **Data Collection and Inventory Years**: This inventory used data collected from the year 2018. This allows the inventory to be comparable to other nationwide inventories which typically include assessments from 2018 data, while also providing the best data available from the City, CCOG, and relevant special districts. The team worked closely with City staff and CCOG to identify and review available data for the baseline inventory and forecast of GHG emissions for the City. Data sets used for the findings in this report are highlighted throughout, as well as detailed in the appendices.
- **Inventory Tools**: For the community-wide and government operations inventories, ClearPath[19] was used. ClearPath, available through ICLEI, calculates, monitors, and forecasts GHG emissions based on reported activity data and demographic information. ClearPath was developed to assist in the preparation of USCP and LGOP-compliant GHG inventories.

More details about specific tools and methodologies are highlighted in their respective sections throughout this report.

[19] ClearPath. (2021). ICLEI - Local Governments for Sustainability USA.

GHG Emissions Inventory

Inventory Methodologies

Understanding a GHG Emissions Inventory

Achieving tangible greenhouse gas (GHG) emissions reductions in order to impact climate change requires identifying baseline emissions levels, sources, and activities that generate emissions in the community. Warming trends across the region have increased the frequency and severity of catastrophic wildfire, diminished snowpack, rain-on-snow and flooding events, low reservoirs and water supply, and decreased biodiversity. These effects are beginning to take hold locally, threatening not only the environment but also the City of Angels Camp's (City's) way of life.

This report presents emissions from the City as a whole, where the government operations emissions are a subset of community-wide emissions and should not be added to community emissions totals since they are already included in the community-wide data. The inventory uses the latest methodology and modeling to develop a 2018 inventory, looking at GHG emissions generated by energy, transportation, solid waste, and water and wastewater. Emissions from carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are accounted for and calculated as the carbon dioxide equivalent (CO_2e). The government operations inventory only includes emissions from sources and activities over which the City has influence.

As local governments and public agencies have continued to join the greater climate action movement, the need for standardized approaches to quantifying GHG emissions has proven essential. The inventory utilizes the approach and methods provided by the U.S. Community Greenhouse Gas Emissions Protocol, in addition to the Local Government Operations Protocol.

Emissions Protocols

U.S. Community Protocol[20]

The City's community-wide GHG inventory was conducted in accordance with the U.S. Community Protocol (USCP) released by the organization ICLEI in October 2012 (updated in 2019) and represents the current national standard in guidance for community-wide GHG emissions inventories. The USCP improved on earlier protocols by establishing additional

[20] U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (2021). ICLEI - Local Governments for Sustainability USA.

reporting requirements for community-wide inventories and providing improved accounting guidance for quantifying emissions. The improvements include the addition of electricity transmission and distribution losses, the delineation of community wastewater and potable water energy use emissions, improved methods to estimate residential non-utility fuel use emissions, and improved methods to estimate wastewater process emissions. The State of California Governor's Office of Planning and Research recommends that California local governments follow the USCP when undertaking their GHG emissions inventories.

Local Government Operations Protocol[21]

The Local Government Operations Protocol (LGOP) was released in 2008 (updated in 2010), by ICLEI, the California Air Resources Board (CARB), and the California Climate Action Registry (CCAR) to serve as the national standard for quantifying and reporting GHG emissions from local government operations. The purpose of the LGOP is to provide the principles, approach, methodology, and procedures needed to develop a government operations GHG emissions inventory. The LGOP was used to guide the government operations inventory.

Greenhouse Gas Global Warming Potential

GHG emissions are commonly aggregated and reported in terms of equivalent-carbon-dioxide-units, or CO_2e. This carbon dioxide equivalent combines the three different gaseous emissions types into one single unit based on the Global Warming Potential (GWP) of each gas, which is a measure of the amount of warming a GHG may cause over the span of 100 years, measured against the amount of warming caused by carbon dioxide. Converting all emissions to equivalent-carbon-dioxide-units allows for the comparison of different GHGs in similar terms. For example, methane is 28 times more powerful than carbon dioxide in its warming effect over 100 years, so one metric ton (MT) of methane emissions is equal to 28 MT of carbon dioxide equivalents. **Table 1** presents the GWPs of the commonly occurring GHGs according to the Intergovernmental Panel on Climate Change's 5th Assessment Report, reflecting the most recent scientific consensus. Of those seven, this inventory focused on three main GHGs: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

[21] Local Government Operations Protocol (2021). The Climate Registry.

Table 1. Greenhouse Gas Global Warming Potentials

Greenhouse Gas	Chemical Formula	IPCC 5th Assessment Global Warming Potential[22]
Carbon Dioxide	CO_2	1
Methane	CH_4	28
Nitrous Oxide	N_2O	265
Hydrofluorocarbons	Various	4 - 12,400
Perfluorocarbons	Various	6,630 - 11,100
Sulfur Hexafluoride	SH_6	23,500
Nitrogen Trifluoride	NF_3	16,100

Quantifying Greenhouse Gas Emissions

Sources and Activities

Communities contribute to GHG emissions in a number of ways: 1) GHG emissions that are produced by sources located within the defined boundary, and 2) GHG emissions produced as a consequence of community activities. All of the emissions in this report have been quantified using calculation-based methodologies. Calculation-based methodologies look at GHG-emitting activities and determine how much of each activity occurred in the City. Then an emissions factor is developed or cited from literature for each specific activity and the two figures are multiplied together to arrive at the total emissions produced by each activity within the City:

Activity or Source Data x Emissions Factor = Emissions Produced by Activity.

Activity or source data refers to the relevant measurement of energy use or other GHG-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, or annual vehicle miles traveled (VMT). Standard emissions factors are applied to activity or source data to determine the associated emissions. Emissions factors are typically expressed as emissions per unit of activity or source data (e.g. lbs CO_2/kWh of electricity). ICLEI's ClearPath toolkit was used to complete these quantifications.

The report for community-wide emissions measures GHG emissions in four primary areas: energy use, including propane and electricity used to heat and cool buildings; transportation, including emissions from vehicle operations; solid waste, including materials deposited in landfills that will later decompose; and wastewater treatment. The

[22] Global Warming Potential Values. (2014). Greenhouse Gas Protocol. IPCC.

report measures both emissions occurring within the City and emissions originating outside the City for use inside the City, in order to create a measure of total emissions.

The second part of this report, focused on emissions from government operations, measures emissions in five primary areas: energy use from buildings and facilities, vehicle fleet, employee commutes, solid waste generation, and water and wastewater.

The basic process followed for the inventory is to measure sources of emissions (such as power generation) and activities that create emissions (such as vehicle operations), and convert those sources and activities into equivalent GHG emissions. The observed emissions allow for measurement over time of progress toward meeting climate policy goals. The report also uses assumptions in City-wide growth to create a forecast of changes to occur in GHG emissions, which can aid in decision making.

Information only items are GHG emissions that are not included in the GHG emissions totals, though are reported to provide context. Information items are reported separately from the totals either to avoid overlap with other reported emissions or because they are excluded from GHG inventories by protocol guidance. Information items can include emissions such as:

- Emissions associated with electric vehicles. The emissions are included in residential and non-residential electricity emissions totals, and reported as an information item in the transportation sector.
- Emissions associated with energy used to distribute water and collect wastewater, as they are included in commercial community-wide electricity usage totals.

Forecast Methodology

After the completion of the emissions inventories, forecasts of emissions were developed under business-as-usual (BAU) and adjusted business-as-usual scenarios (ABAU). A BAU scenario does not account for any local, state, or federal policy that would impact future GHG emissions. The BAU forecasts estimate future community-wide GHG emissions in the years 2030, 2035, and 2045. BAU forecasts are based on two inputs — current emissions data and growth rates. Baseline emissions data came from the 2018 inventory. Growth rates were calculated based on projected growth of relevant indicator variables.

BAU projections are intended to demonstrate the expected growth in GHG emissions if no reduction measures are taken. The BAU forecast is beneficial in that it allows for comparison between forecasted and actual observed emissions to determine what

emissions reduction progress has been made to date. BAU forecasts also can help assess whether the City can achieve its emissions reduction targets through current efforts.

An adjusted scenario forecast, or adjusted BAU (ABAU), accounts for legislative adjustments and projected emissions reductions resulting from legislative action. This includes future updates to statewide vehicle fleet standards and renewable portfolio standards. ABAU forecasts are developed using two inputs - current emissions data and either BAU projections or adjusted rates of growth or decay.

Community-Wide Inventory Results

The community-wide inventory is an assessment of the City of Angels Camp's (City) greenhouse gas (GHG) emissions resulting from activities by City residents, businesses and visitors for the year 2018. The community-wide inventory includes:

1. Use of electricity
2. Use of fuel in buildings or other stationary use
3. Use of fuel for on-road transportation by passenger and freight vehicles
4. Use of energy for potable water and wastewater distribution and treatment processes
5. Generation of solid waste by the community

Based on the methodologies outlined above, inventory results provide information on the sources of GHG emissions, the relative magnitude of those emissions by source, and emissions trends in the City over time.

Community-Wide GHG Emissions Summary

Key Findings

- In 2018, the community, including residents and businesses, of Angels Camp emitted an estimated 25,193 metric tons (MT) CO_2e.
- The largest contributor to community emissions in the inventory is community-wide transportation (73%), which includes on-road and off-road vehicle emissions.
- In combination, the transportation and energy sectors produce roughly 96% of the community-wide emissions in the City, and therefore have the most potential for emissions reductions.
- By conducting periodic GHG emissions inventories as data becomes more robust and methodologies improve, the City can get an even clearer picture of the GHG emissions in the community, and monitor and evaluate any reduction efforts taken.

Overview of 2018 Community-Wide Inventory

In 2018, the City emitted 25,193 MT CO_2e.[23] The transportation sector was the largest source of emissions, followed by energy, solid waste, and water and wastewater, as shown in **Figure 1**. On a per capita basis, emissions were 6.46 MT CO_2e per City resident annually. Note that per capita emissions, however, may not be directly comparable to inventories from other jurisdictions, as overall inventory methodologies can differ.

Figure 1. 2018 Emissions Summary

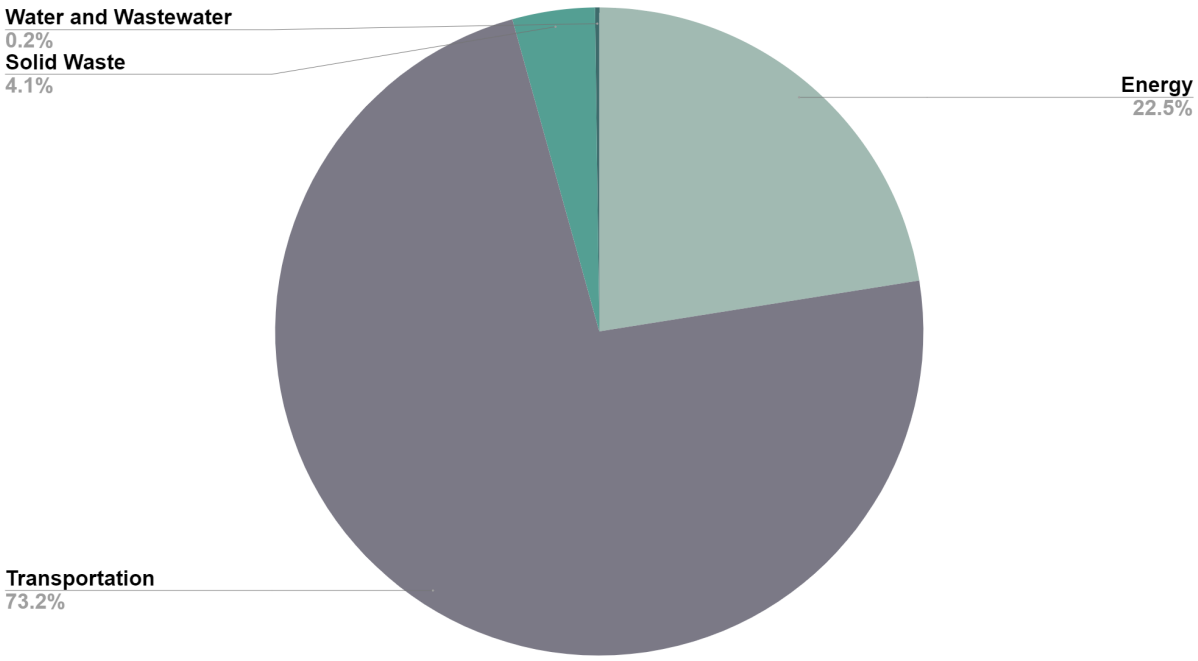


Table 2. 2018 Emissions Summary

Sector	MT CO_2e	% of Total Emissions
Energy	5,667	22.49%
Transportation	18,437	73.18%
Solid Waste	1,037	4.12%
Water and Wastewater	52.78	0.21%
Total	**25,193**	**100%**

[23] Community-Master-Data-Workbook. (2021). Sierra Business Council.

Energy

The energy sector consists of building electricity and other fuel use (propane and wood), as noted below **Table 3.** Aggregated electricity use data was provided by Pacific Gas & Electric Company (PG&E) and Calaveras Public Power Agency (CPPA)[24] and is shown in **Figure 2** below. **Figure 2** below shows emissions by energy type, and it is important to note that there are very little emissions coming from electricity provided by CPPA, as CPPA electricity is generated through various hydroelectric projects.

While there is no natural gas usage in the City, propane significantly contributed to emissions for the energy sector. Propane and wood usage estimates for 2018 were taken from the U.S. Energy Information Administration (EIA) and scaled using household energy use estimates from the U.S. Census American Community Survey.[25] These estimates are shown in **Figure 2**.

The electricity use and emissions metrics include transmission and distribution (T&D) losses for 2018. T&D losses are slight losses in electrical energy as a result of transmission across power lines. T&D losses were measured at 4.8% of end use consumption in 2018 according to the eGRID gross loss rates for the Western Region.[26]

Refer to the **Appendices A and B** for data on 2018 emissions factors.

[24] Electricity data provided by PG&E and CPPA. Located in the Community-Master-Data-Workbook.
[25] Propane and wood data estimated using data from the U.S. Energy Information Administration and U.S. Census Bureau American Community Survey.
[26] Transmission and distribution loss rates were provided by the U.S. Environmental Protection Agency eGRID Data Explorer.

Figure 2. Emissions by Energy Type

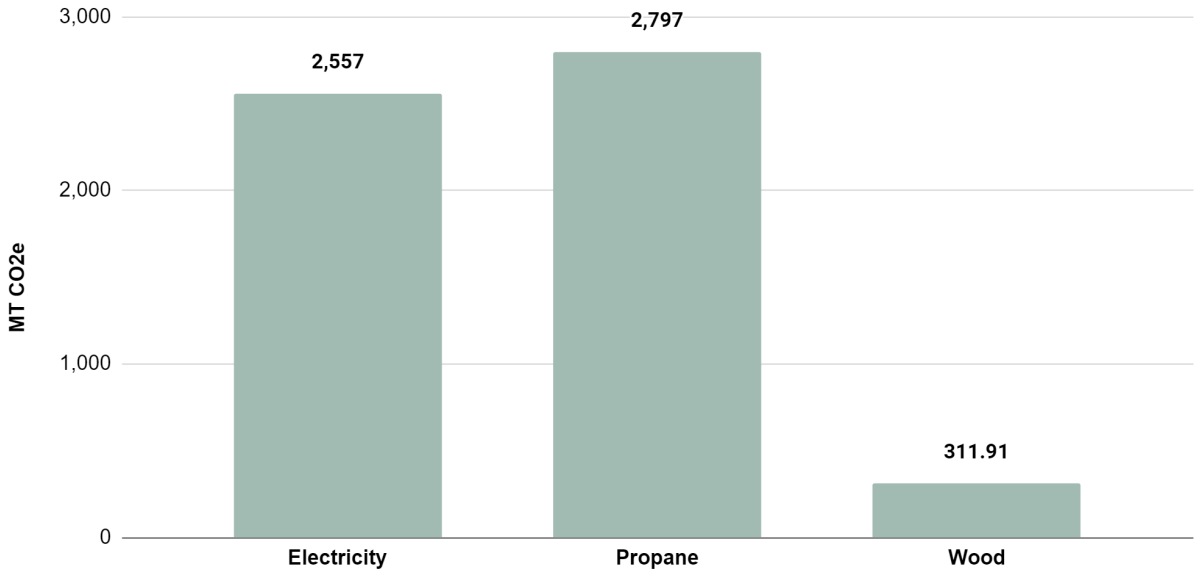


Table 3. Energy Activity Data and Emissions

Energy Type	Amount	Unit	Emissions (MT CO_2e)	Data Source
Residential Electricity (PG&E)	13,351,915	kWh	1,260	PG&E
Residential T&D Loss Rate	4.80	%	144.93	eGRID
Residential Propane	485,623	gallons	2,743	EIA / ACS
Residential Wood	31,313	MMBtu	311.91	EIA / ACS
Commercial Electricity (PG&E)	10,691,523	kWh	1,009	PG&E
Commercial Electricity (CPPA)	1,399,724	kWh	25.90	CPPA
Commercial Electricity T&D Loss Rate	4.80	%	117.29	eGRID
Commercial Propane	9,735.85	gallons	54.98	EIA / ACS
Total Emissions			**5,667**	

Transportation

In 2018, on-road vehicle miles traveled (VMT) data was provided for the Calaveras Council of Governments' (CCOG) travel demand model and scaled to the City from aggregated

County data using population.[27] The breakdown of VMT and emissions by trip type is noted in **Table 4** below. Off-road fuel usage data was provided by the California Air Resources Board's OFFROAD2017 model, including fuel usage data from off-road activity relating to construction and other industrial and light commercial activities. The off-road vehicle data was originally calculated for the County and was scaled down to City usage using population. On- and off-road activity and emissions data are shown in **Figure 3** and **Table 4** below.

Figure 3. On-Road and Off-Road Emissions

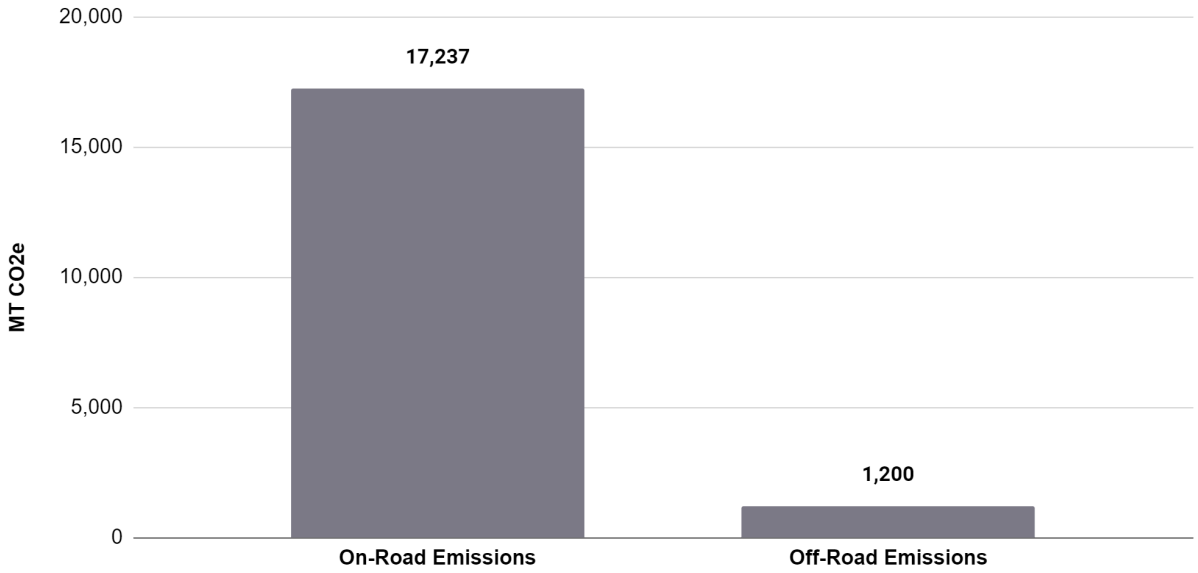


Table 4. Vehicle Miles Traveled and Emissions from Transportation

Activity / Source	Miles Traveled (Miles)	Gasoline Use (Gallons)	Diesel Use (Gallons)	Liquid Propane Gas Use (Gallons)	Emissions (MT CO_2e)
On-Road Vehicles	34,937,859				**17,237**
Trip Starts and Ends In Boundary	15,370,293				7,583
Trip Starts In and Ends Out of Boundary	9,783,783				4,827
Trip Starts Out and Ends In Boundary	9,783,783				4,827
Off-Road Vehicles		14,087	102,319	3,003	**1,200**
Total Emissions					**18,437**

[27] On-Road data provided by CCOG. Off-Road data provided by CARB OFFROAD2017 Model, EPA Emissions Factors, and 5th Assessment Global Warming Potentials.

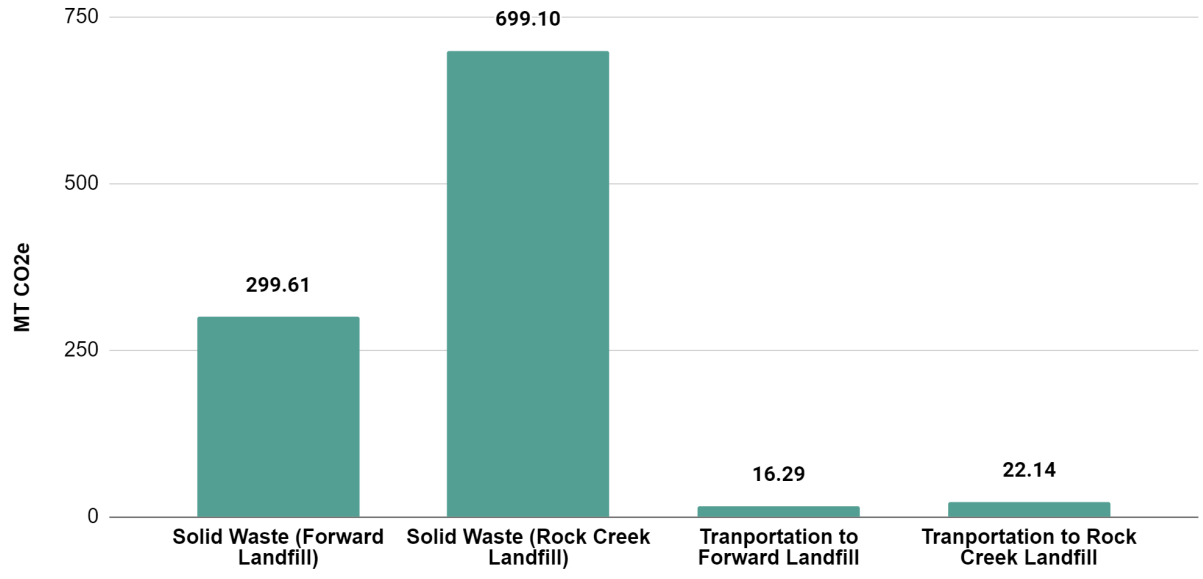
Solid Waste

In 2018, total City-wide solid waste sent to the landfill was approximately 3,519 tons.[28] Solid waste generated in the City is primarily sent to Forward Landfill in Manteca and Rock Creek Landfill in Farmington. The figure below lists the total solid waste tonnage sent to both Forward and Rock Creek Landfills. Both landfills have methane collection systems in place. Solid waste tonnage data was provided by Calaveras County Integrated Waste Management and scaled down to City usage. Emissions from transportation of solid waste were also calculated using the annual tonnage and the distance to and from each landfill.

Table 5. Solid Waste Generation Data and Emissions

Landfill	Solid Waste (Tons)	Emissions (MT CO_2e)	Distance to Landfill (Miles)	Emissions (MT CO_2e)	Data Source
Forward Landfill	1,056	299.61	55.10	16.29	Calaveras County Integrated Waste Management, CalRecycle, and Google Maps
Rock Creek Landfill	2,463	699.10	32.10	22.14	
Total	**3,519**	**998.71**		**38.43**	

Figure 4. Solid Waste Emissions



[28] Solid waste data provided by Calaveras County Integrated Waste Management. Located in Community-Master-Data-Workbook.

Water and Wastewater

Emissions from water and wastewater for the year 2018 were 52.78 MT CO_2e.[29] Electricity emissions from water distribution and wastewater collection and treatment were accounted for in the City-wide calculations for the energy sector and were considered "information only" items in this section to avoid double counting. Wastewater emissions are primarily associated with the City's treatment processes.

Table 6. Electricity Use for Potable Water Supply - Information Item

Energy Type	Electricity Use (kWh)	Water Treated (Gallons)	Data Source
Electricity (CPPA)	197,600	321,800,000	CPPA, USCP, City of Angels Camp

Table 7. Electricity Use for Wastewater Treatment - Information Item

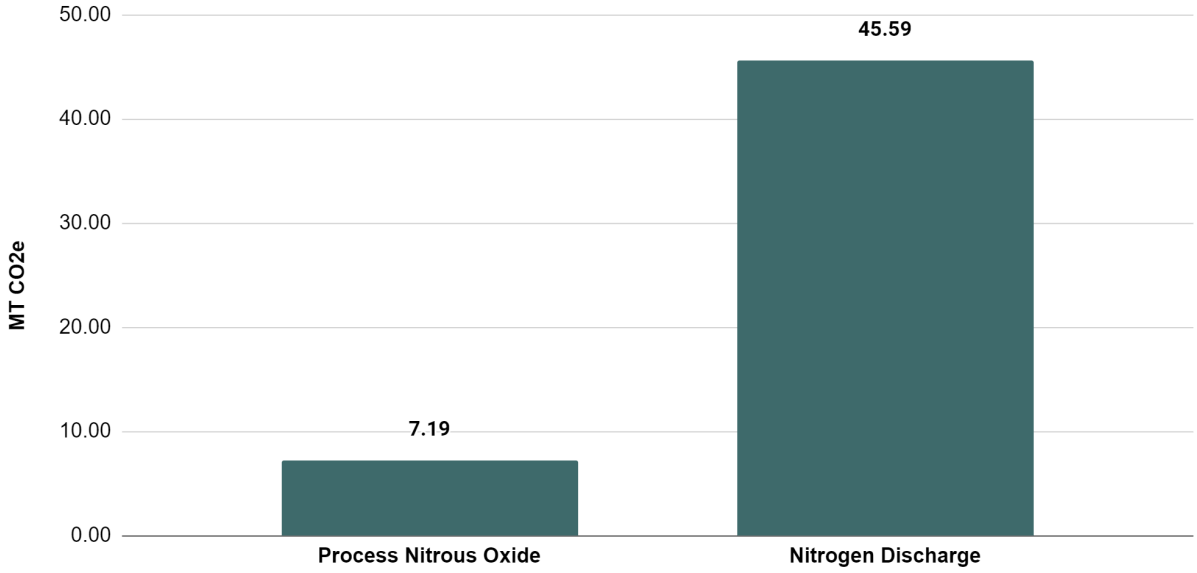
Energy Type	Electricity Use (kWh)	Water Treated (Gallons)	Data Source
Electricity (CPPA)	1,400,000	168,000,000	CPPA, USCP, City of Angels Camp

Table 8. Wastewater Treatment Process Data

Treatment Process	Emissions (MT CO_2e)
Nitrogen Discharge	45.59
Process N_2O	7.19
Total Emissions	**52.78**

[29] Water and wastewater data provided by the City of Angels Camp. Located in Community-Master-Data-Workbook.

Figure 5. Water and Wastewater Emissions



Government Operations Inventory Results

This section presents a detailed analysis of greenhouse gas (GHG) emissions resulting from the City of Angel's Camp's (City) government operations. The government operations emissions are a subset of community-wide emissions and should not be added to community emissions totals since they are already included in the community-wide data. The emissions included in this inventory were determined using the operational control framework. Included are emissions from buildings, facilities and lighting energy use, water distribution and wastewater treatment emissions, and vehicle fleet fuel use emissions. These are emissions sources and activities for which the City has the full authority to introduce and implement operating policies. The government operations inventory also includes two additional emissions sectors for which the City has limited control: emissions from employee-generated solid waste and emissions from employees' personal commutes to work. Including these optional sources is recommended strongly by the Local Government Operations Protocol (LGOP) even though the City does not have full operational control.

Based on the methodologies previously outlined, inventory results provide information on the sources of GHG emissions and the relative magnitude of those emissions by source for the City operations.

Government Operations GHG Emissions Summary

Key Findings

- In 2018, the City's government operations emitted an estimated 511 metric tons (MT) CO_2e, which includes emissions sources and activities for which the City has the authority to introduce and implement operational policies.
- The largest contributor to government operations emissions in the inventory is the vehicle fleet (41%), which includes on-road and off-road vehicle emissions.
- In combination, the vehicle fleet and employee commute sectors produce more than 67% of the government operations emissions in the City, and therefore have the most potential for emissions reductions.
- Emissions from government operations account for 2.0% of total community-wide emissions.
- By conducting periodic GHG emissions inventories as data becomes more robust and methodologies improve, the City can get an even clearer picture of the government operations GHG emissions, and monitor and evaluate any reduction efforts taken.

Overview of 2018 Government Operations Inventory

In 2018, City facilities and operations emitted 511 MT CO_2e.[30] The vehicle fleet sector was the largest source of emissions, followed by employee commute, water and wastewater, solid waste, and buildings and facilities.

[30] LGO-Master-Data-Workbook. (2021). Sierra Business Council.

Figure 6. 2018 Emissions Summary

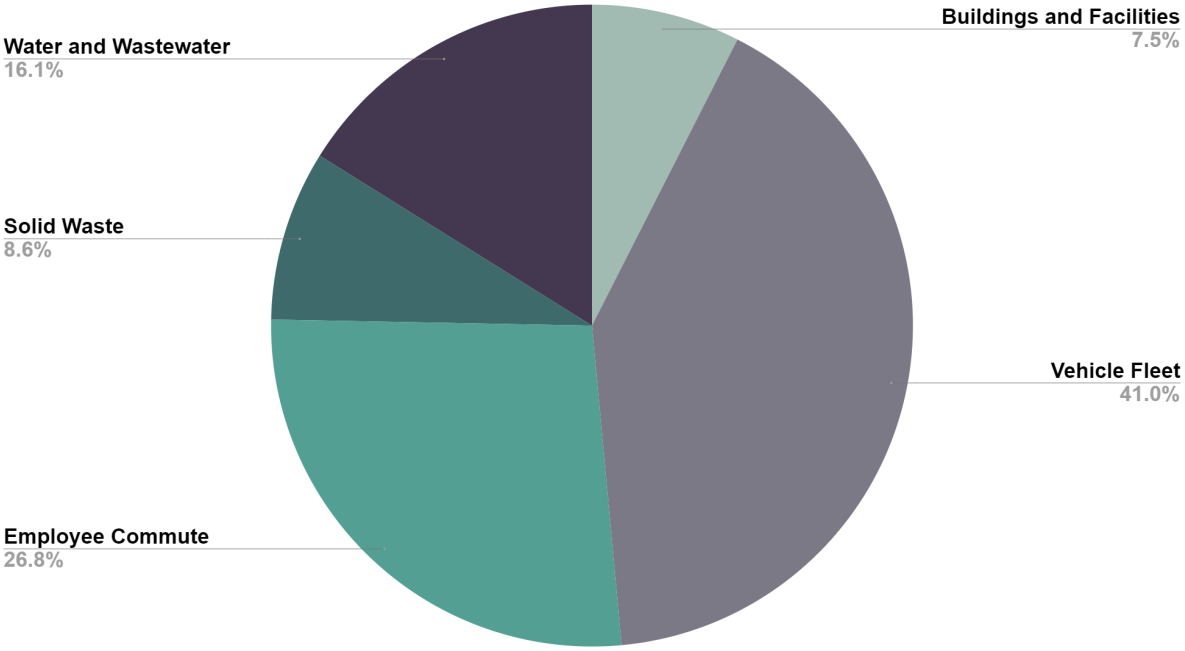


Table 9. 2018 Emissions Summary

Sector	MT CO_2e	% of Total Emissions
Buildings and Facilities	38	7.49%
Vehicle Fleet	210	41.04%
Employee Commute	137	26.77%
Solid Waste	44	8.58%
Water and Wastewater	82	16.12%
Total	**511**	**100%**

Buildings and Facilities

The buildings and facilities sector consists of building electricity and propane in City buildings and facilities, as noted below **Table 10**. Aggregated electricity use data was provided by Pacific Gas & Electric Company (PG&E) and Calaveras Public Power Agency (CPPA)[31] and is shown in **Figure 7** below. There are very little emissions coming from

[31] Electricity data provided by PG&E and CPPA. Located in the LGO-Master-Data-Workbook.

electricity provided by CPPA, as CPPA electricity is generated through various hydroelectric projects. There is no natural gas used within City operations.

Figure 7. Emissions from Buildings and Facilities Energy Use

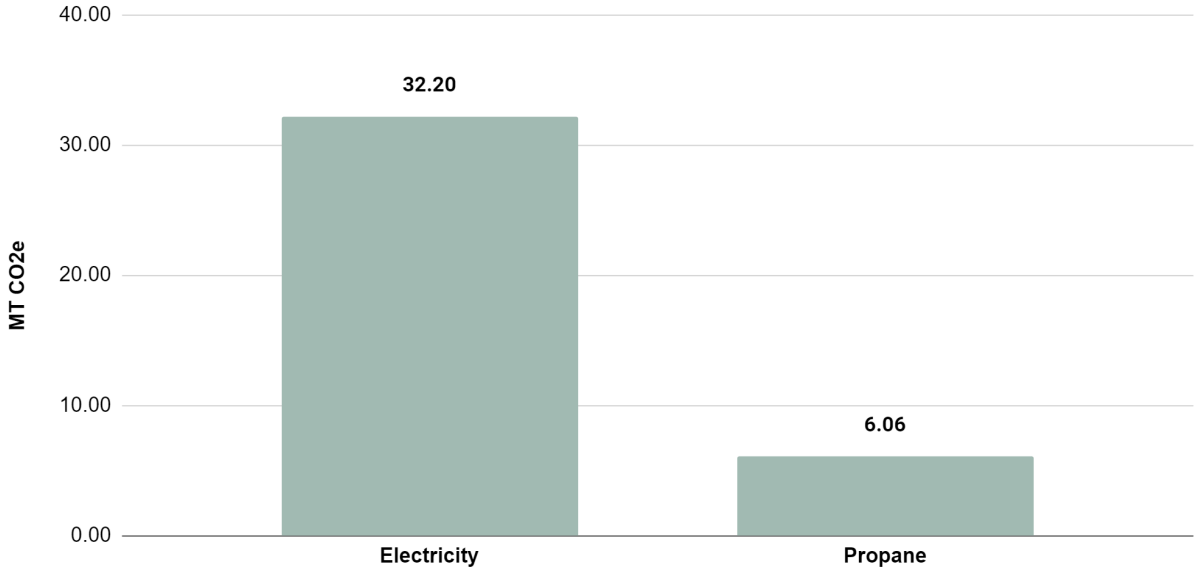


Table 10. Energy Use and Emissions from City Buildings and Facilities

Energy Type	Amount	Unit	Emissions (MT CO_2e)	Data Source
Electricity (PG&E)	66,725	kWh	6.30	PG&E
Electricity (CPPA)	1,399,724	kWh	25.90	CPPA
Propane	1,073	gallons	6.06	EIA / ACS
Total Emissions			**38.26**	

Vehicle Fleet

Vehicle fleet data for 2018 was provided by the City's Public Works, Police, and Fire Departments.[32] This data set included vehicle type, fuel type, total annual miles traveled, and gallons of fuel or hours used. All off-road vehicles were categorized as small utility vehicles in ClearPath. **Table 11** below shows breakdown of passenger, light duty, and heavy duty vehicles, in addition to fuel usage by type.

[32] Vehicle fleet data provided by the City of Angels Camp. Located in LGO-Master-Data-Workbook.

Figure 8. Vehicle Fleet Emissions

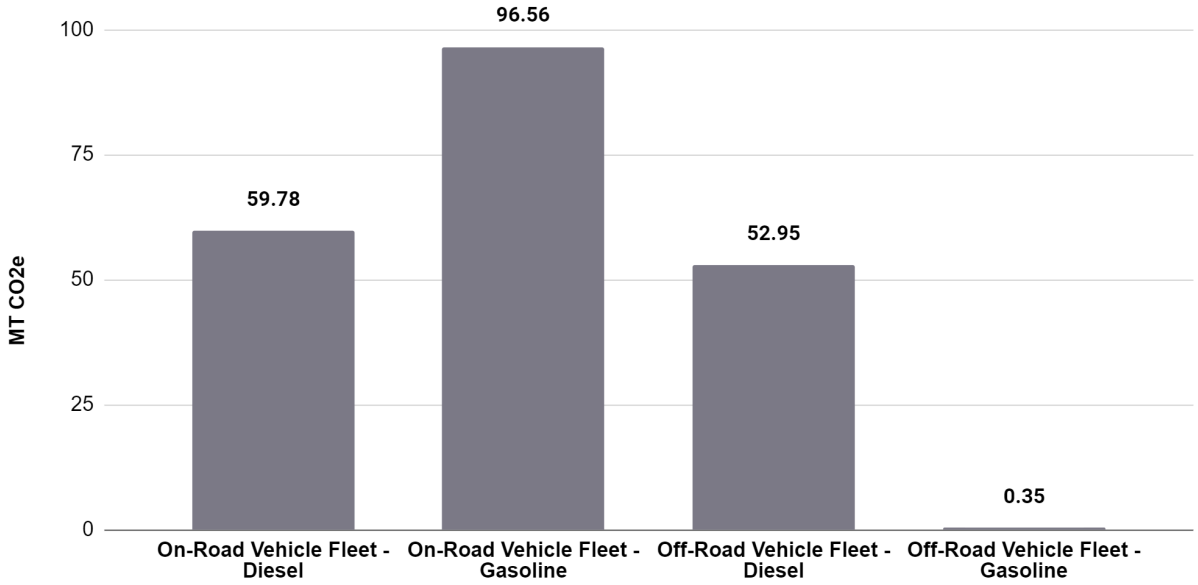


Table 11. Vehicle Fleet Breakdown and Emissions

Activity / Source	Annual VMT	Fuel Used (Gallons)	Emissions (MT CO_2e)
On-Road Vehicle Fleet - Diesel	49,144	5,849	59.78
On-Road Vehicle Fleet - Gasoline	185,102	10,905	96.56
Off-Road Vehicle Fleet - Diesel	N/A	5,186	52.95
Off-Road Vehicle Fleet - Gasoline	N/A	39	0.35
Total Emissions			**209.64**

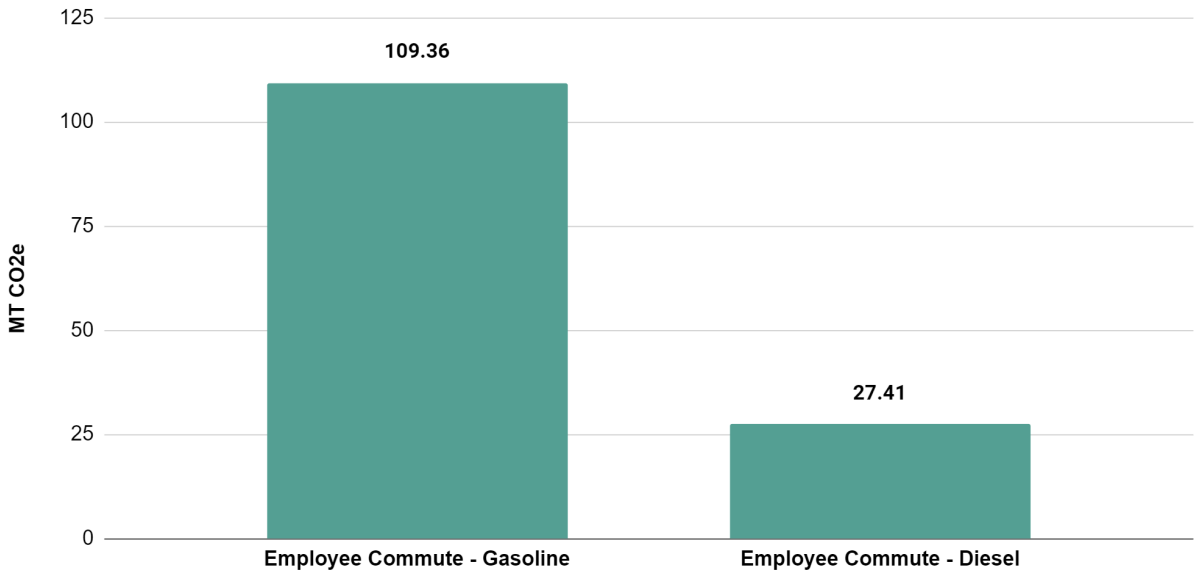
Employee Commute

In order to compile an employee commute data set, a survey was distributed both electronically and by hard copy to all City employees. The survey included questions regarding mileage to and from work, how many days per week were spent driving to work, vehicle type, and fuel type. It was asked that employees fill out this survey for their "pre-COVID-19" commutes. There were 36 employees and 4 contractors in 2018. In total, there were 40 responses, and it was shown that all employees drive alone to work. Total vehicle miles traveled are categorized by gasoline and diesel, as well as by passenger vehicle or light duty truck. The City Employee Commute survey is included in **Appendix I.**

Table 12. Employee Commute VMT Breakdown and Emissions

Activity / Source	Annual VMT	Emissions (MT CO_2e)
Employee Commute - Gasoline	254,250	109.36
Employee Commute - Diesel	49,271	27.41
Total Emissions		**136.77**

Figure 9. Employee Commute Emissions



Solid Waste

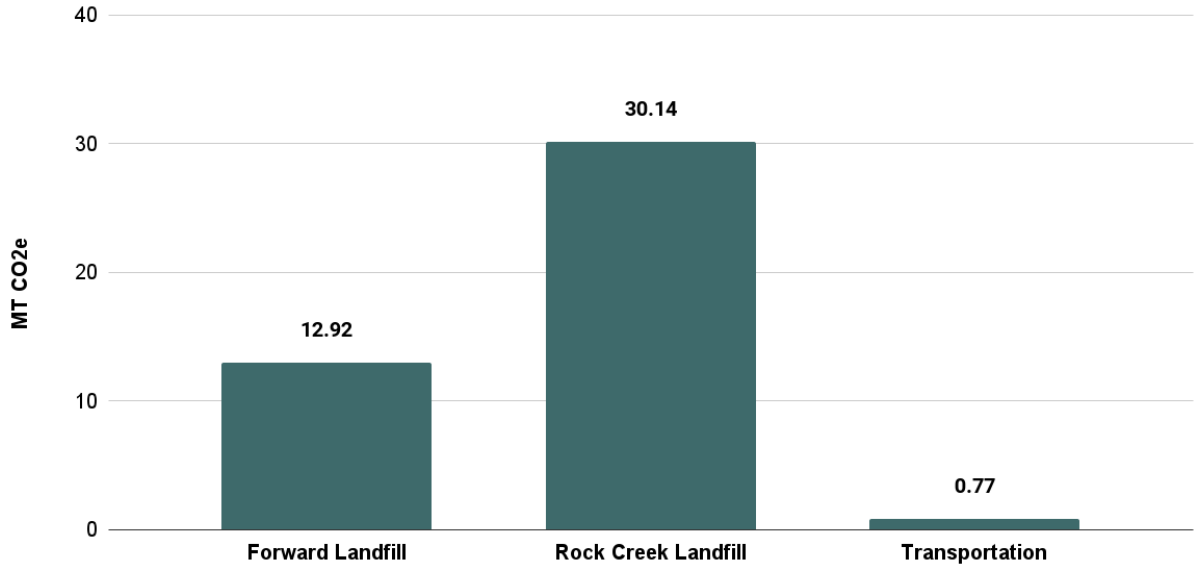
In 2018, solid waste generated by City government operations was approximately 73 tons.[33] Solid waste generated by City facilities is sent to Forward Landfill in Manteca and Rock Creek Landfill in Farmington. In **Figure 10** below, you can see total solid waste tonnage sent to both Forward and Rock Creek Landfills. Both landfills have methane collection systems in place. Solid waste tonnage data was provided by the City. Emissions from transportation of solid waste were also calculated using the annual tonnage and the distance to and from each landfill.

[33] Solid waste data provided by the City of Angels Camp. Located in LGO-Master-Data-Workbook.

Table 13. City Facility-Generated Solid Waste

Landfill	Solid Waste (Tons)	Emissions (MT CO_2e)	Distance to Landfill (Miles)	Emissions (MT CO_2e)	Data Source
Forward Landfill	22.00	12.92	55.10	0.31	Calaveras County Integrated Waste Management, CalRecycle, and Google Maps
Rock Creek Landfill	51.34	30.14	32.10	0.46	
Total	**73.34**	**43.06**		**0.77**	

Figure 10. Emissions from City Facility-Generated Solid Waste



Water and Wastewater

Emissions from City-operated water and wastewater facilities for the year 2018 totaled 82.3 MT CO_2e.[34] Water and wastewater emissions are primarily associated with energy used to distribute water, collect wastewater, and the City's treatment processes. Data was provided by the City and is outlined below in **Table 14, Table 15** and **Table 16**. Under the LGOP, these emissions are included in the government operations inventory because they are owned and operated by the City.

[34] Water and wastewater data provided by the City of Angels Camp. Located in LGO-Master-Data-Workbook.

Table 14. City-Operated Potable Water Supply Electricity

Energy Type	Electricity Use (kWh)	Water Treated (Gallons)	Emissions (MT CO_2e)	Data Source
Electricity (CPPA)	197,600	321,800,000	3.66	CPPA, USCP, City of Angels Camp
Total Emissions			**3.66**	

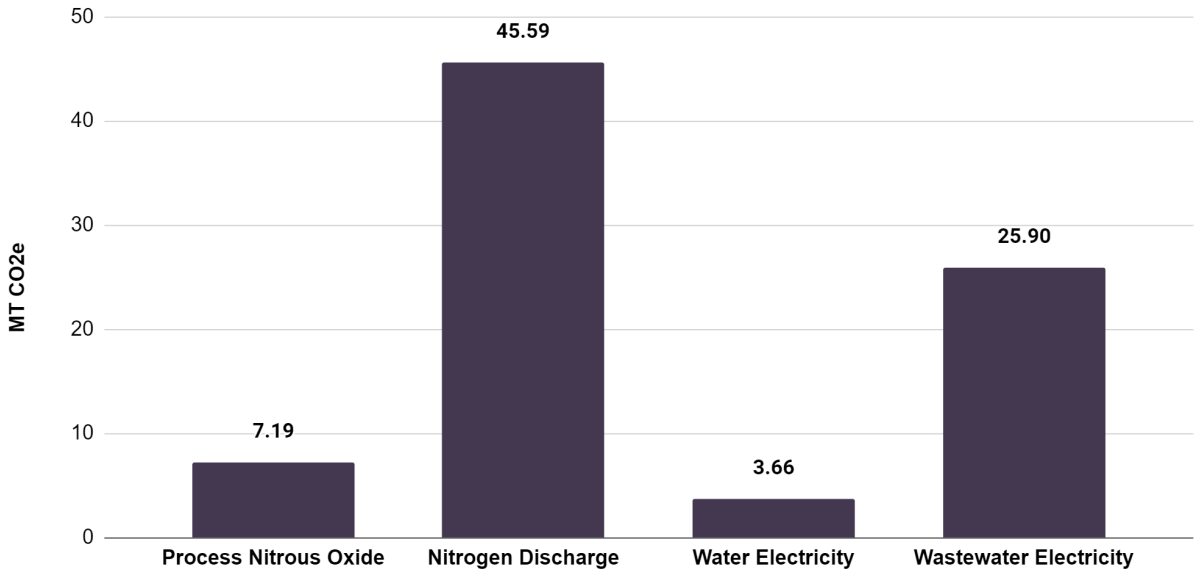
Table 15. City-Operated Wastewater Treatment Electricity

Energy Type	Electricity Use (kWh)	Wastewater Treated (Gallons)	Emissions (MT CO_2e)	Data Source
Electricity (CPPA)	1,400,000	168,000,000	25.90	CPPA, USCP, City of Angels Camp
Total Emissions			**25.90**	

Table 16. Wastewater Treatment Process Data

Treatment Process	Emissions (MT CO_2e)
Nitrogen Discharge	45.59
Process N_2O	7.19
Total Emissions	**52.78**

Figure 11. Water and Wastewater Emissions



Emissions Forecasting

Business-as-Usual Forecasts

Business-as-usual (BAU) forecasts were conducted for the City of Angels Camp (City) after the completion of the emissions inventory to provide an estimate of future emissions in each sector.[35] The BAU scenarios take the emissions from a snapshot in time and project them out over time, assuming no other changes or variables that might otherwise affect emissions. In general, BAU emissions forecasting does not account for any local, state, or federal policy that would impact future GHG emissions, nor does it account for potential changes in technology or individual consumption behavior. The BAU forecasts estimate how annual emissions would change from 2018 to 2030, to 2035, and to 2045. These years align with existing regional, local, and statewide emissions reduction goals.

The BAU forecast is based on two inputs, baseline emissions data and growth rates, both of which are presented in **Appendix M** and **Appendix N**. Growth rates were calculated using projections of population, employment rates, and several other indicator variables. For the City forecasts, two forecast scenarios were calculated due to differences in population growth rates from differing years (one references an increasing population growth rate from 2018 data and the other a declining population growth rate from 2021 data). Both of these forecasts and more detailed information on the reasoning behind including two BAU forecasts are provided in **Appendix M**. Only the forecasts using 2018 DOF data are included in this section of the report.

Calculating the emissions forecast is achieved by isolating an indicator variable for the various sectors and sub-sectors that were evaluated in the inventory, then assessing how that indicator variable is projected to increase or decrease into the future, and applying that rate of change to the emissions from that sector or sub-sector.

For example, to forecast residential energy, the team looked at the different projected rates of change for Calaveras County population out to 2045 (from 2021 and 2018 Department of Finance population projection data), then applied those rates of change to the emissions coming from the City's residential energy sector to arrive at our BAU forecasts. This process was applied to each sector and sub-sector using associated growth indicators.

Table 17 below displays the various indicator variables and their data sources for each sector. Forecasts are based on projections provided by commonly-used sources, however

[35] Data located in the City of Angels Camp Forecasts spreadsheet.

like other predictive modeling, there is inherent uncertainty in these predictions. Likewise, significant events, like the 2020-2021 COVID pandemic, can disrupt a projection in unexpected ways. As this inventory was based on data from before the pandemic, resulting impacts are not accounted for as they are as of yet unknown. Additionally, data that is specific and robust for small rural regions, like Calaveras County, can be difficult to obtain. Regardless, forecasting can be a useful tool to help understand the actions needed to reach emissions reduction targets.

Table 17. Business-as-Usual Emissions Forecast Variables & Data Sources

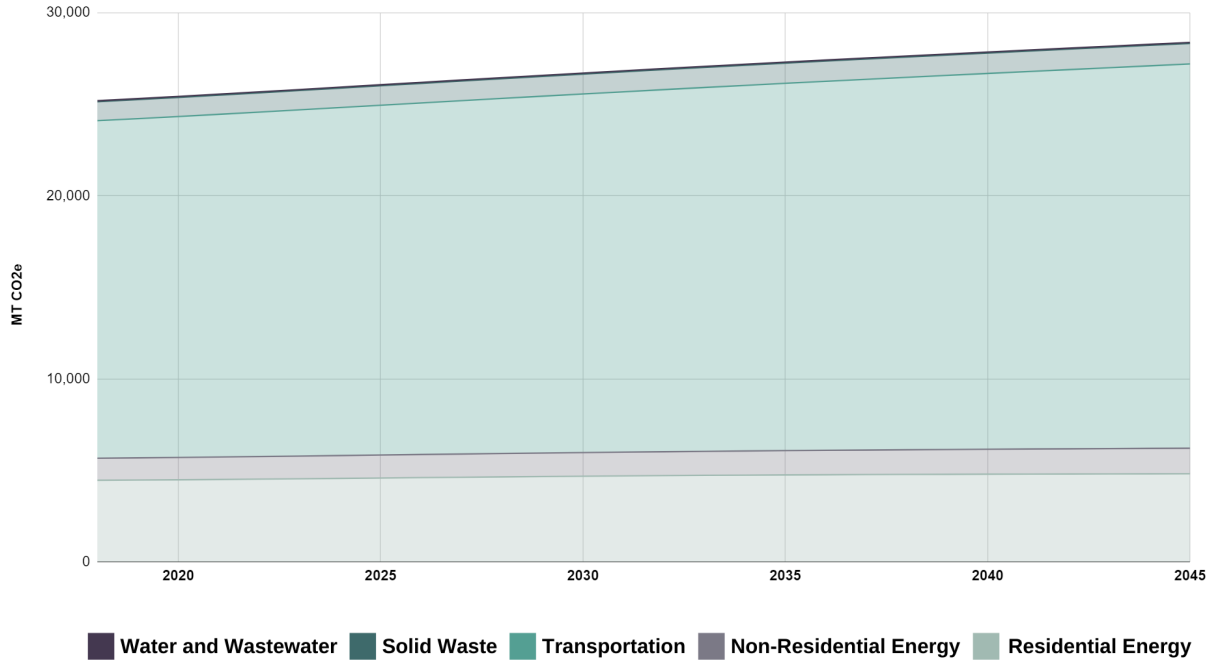
Sector	Sub-sector	Indicator Variable	Data Source
Energy	Residential Energy	Population (2018 Projections)	California Department of Finance
	Non-Residential Energy	Employment	California Employment Development Department
Transportation	On-Road Transportation	VMT Projections	Calaveras Council of Governments
	Off-Road Emissions	Population (2018 Projections)	U.S. Census, American Community Survey
Solid Waste	Solid Waste	Population (2018 Projections)	California Department of Finance
Water and Wastewater	Water and Wastewater	Population (2018 Projections)	California Department of Finance

The BAU forecast showed an overall increase in emissions. Under the BAU scenario, emissions are forecast to increase by 6.0% from 2018 to 2030, by 8.4%, from 2018 to 2035, and by 12.7% from 2018 to 2045, for a total increase in emissions from 2018 to 2045 of 12.7%. This equates to 28,378 MT CO_2e projected to be emitted in 2045. **Table 18** and **Figure 12** display the forecast trends.

Table 18. Business-as-Usual Forecasted Emissions by Sector (MT CO_2e) (2018 California Department of Finance Population Projections)

Year	Residential Energy	Non-Residential Energy	Transportation	Solid Waste	Water and Wastewater	Total Emissions and %
2018	4,459	1,207	18,437	1,037	52.78	25,193
2030	4,681	1,291	19,589	1,089	55.41	26,706 **+6.01%**
2035	4,753	1,326	20,064	1,106	56.26	27,305 **+8.39%**
2045	4,815	1,396	20,991	1,120	56.99	28,378 **+12.65%**
Net % Change	**+7.97%**	**+15.66%**	**+13.85%**	**+7.97%**	**+7.97%**	**+12.65%**

Figure 12. City-Wide Business-as-Usual Greenhouse Gas Emissions Forecast (2018 California Department of Finance Population Projections)



Adjusted Business-as-Usual Forecasts

The adjusted scenario forecast, or adjusted BAU (ABAU), projects emissions out to 2045 and accounts for adjustments and projected emissions reductions resulting from legislative

action. This includes projections that include statewide vehicle fleet standards and renewable portfolio standards. ABAU forecasts are developed using two inputs - current emissions data and either BAU projections or adjusted rates of growth or decay. The ABAU forecast illustrates the difference between and forecasted emissions reductions as a result of state policies' emissions reductions targets. This difference represents the reductions that must be made by the jurisdiction in order to reach reduction targets. These factors are influenced over time by changes in climate, population demographics, land-use and transportation patterns, the adoption of new technologies, and measures adopted to reduce greenhouse gas emissions.

As with the BAU forecasts, two forecast scenarios were calculated due to differences in population growth rates from differing years (one references an increasing population growth rate from 2018 data and the other a declining population growth rate from 2021 data). Both of these forecasts and more detailed information on the reasoning behind including two ABAU forecasts is provided in **Appendix M**. Only the forecasts using 2018 DOF data are included in this section of the report.

The below table displays the legislative adjustments that are applied to each emissions sector to calculate the ABAU forecasts.

Table 19. Adjusted Business-as-Usual Emissions Forecast Variables & Data Sources

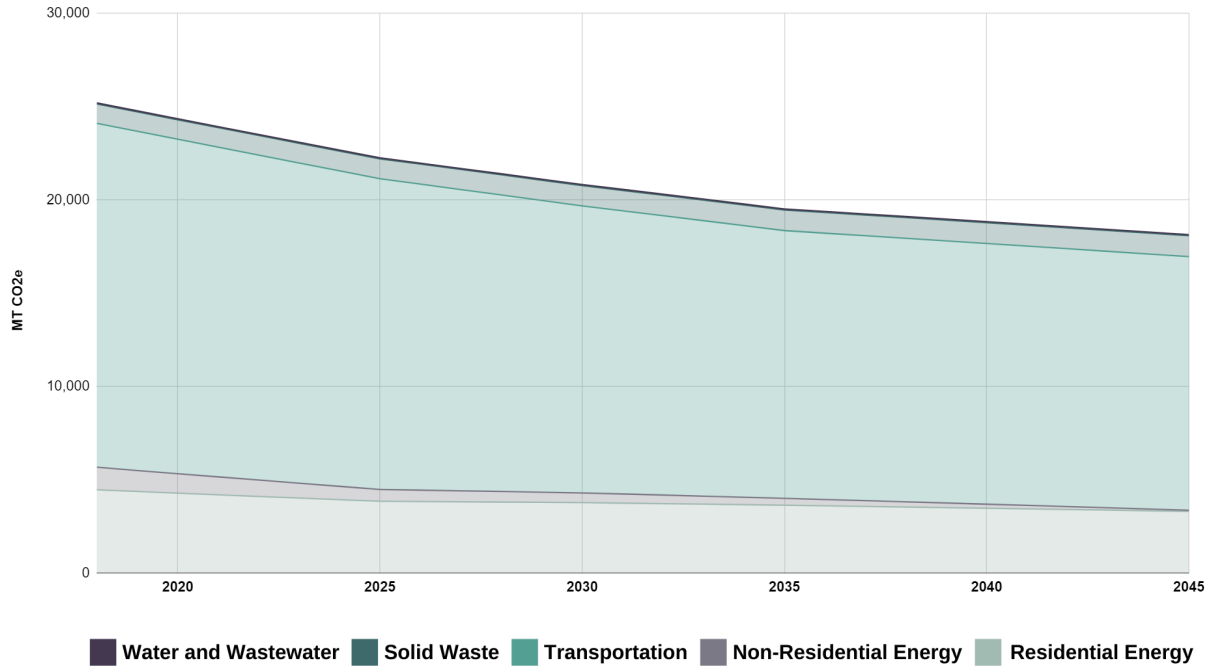
Sector	Sub-sector	Indicator Variable	Data Source
Energy	Residential Energy	Electricity - Renewable Portfolio Standard Other Fuels - Population (2018 Projections)	SB 100 California Department of Finance
	Non-Residential Energy	Electricity - Renewable Portfolio Standard Other Fuels - Employment	SB 100 California Employment Development Department
Transportation	On-Road Transportation	Emissions Rates (EMFAC 2021)	California Air Resources Board
	Off-Road Emissions	Emissions Rates (OFFROAD 2017)	California Air Resources Board
Solid Waste	Solid Waste	Population (2018 Projections)	California Department of Finance
Water and Wastewater	Water and Wastewater	Population (2018 Projections)	California Department of Finance

Under the ABAU scenario, emissions are forecast to decrease by 17.4% from 2018 to 2030, by 22.6% from 2018 to 2035, and by 28.0% from 2018 to 2045, for a total decrease in emissions from 2018 to 2045 of 28.0%. This equates to 18,133 MT CO_2e projected to be emitted in 2045. **Table 20** and **Figure 13** display the forecast trends.

Table 20. Adjusted Business-as-Usual Forecasted Emissions by Sector (MT CO_2e) (2018 California Department of Finance Population Projections)

Year	Residential Energy	Non-Residential Energy	Transportation	Solid Waste	Water and Wastewater	Total Emissions and %
2018	4,460	1,207	18,436	1,037	52.78	25,193
2030	3,769	520	15,386	1,089	55.41	20,819 **-17.36%**
2035	3,631	368	14,352	1,106	56.26	19,513 **-22.55%**
2045	3,299	64	13,594	1,120	56.99	18,133 **-28.02%**
Net % Change	**-26.04%**	**-94.73%**	**-26.26%**	**+7.97%**	**+7.97%**	**-28.02%**

Figure 13. City-Wide Adjusted Business-as-Usual Greenhouse Gas Emissions Forecast (2018 California Department of Finance Population Projections)



GHG Reduction Targets

An important part of the climate action planning process is setting greenhouse gas (GHG) emissions reduction targets. These targets help guide local governments in developing and adopting appropriate energy action policies and programs. Emissions reduction targets also provide a performance metric by which jurisdictions can evaluate progress.

Targets can be set using different methods. Many cities and counties have chosen to follow California state-wide GHG reduction targets codified in Senate Bill 32, to reduce emissions to 40% below 1990 levels by 2030, or the Executive Order S-3-05, to reduce emissions to 80% below 1990 levels by 2050. More recently, others may choose to adopt Executive Order B-55-18, with the goal of reaching carbon neutrality by 2045. ICLEI recommends adopting an 80% below 1990 levels by 2050 target for both community-wide and government operations, or to consider leading by example and setting a more aggressive goal.[36]

Another target setting method applied by local governments is to align their reduction targets with those of nearby jurisdictions. This tactic can provide jurisdictions an opportunity to leverage regional influence and achieve economies of scale when pursuing GHG reduction projects that are cross-jurisdictional.[37]

The City of Angels Camp (City) may also want to take into consideration target setting compliance in regards to the California Environmental Quality Act (CEQA). CEQA section 15183.5 provides guidance on how a GHG plan can be designed to be consistent and comply with criteria for CEQA requirements. Qualified plans that meet CEQA requirements include ones that meet or exceed SB 32, to reduce emissions to 40% below 1990 levels by 2030.

The following table lays out examples of emissions reduction targets adopted by neighboring rural jurisdictions to Calaveras County. The City can reference these targets to help guide their decision on selecting appropriate emissions reduction goals for their community.

[36] ICLEI Guide for Setting a Greenhouse Gas Reduction Target, 2010.

[37] ICLEI Guide for Setting a Greenhouse Gas Reduction Target, 2010.

Table 21. GHG Emissions Reduction Targets

Jurisdiction	Reduction Target
City of Merced	GHG reductions to 1990 levels by 2020
Placer County	GHG reductions of 15% below 2005 levels by 2020, 39% below 2005 levels by 2030, and 69% below 2005 levels by 2050
San Joaquin Valley	GHG reductions of 8% of 2005 levels in 2020, 15.7% in 2035, and 21.2% in 2042
City of South Lake Tahoe	GHG reductions of 50% below 2015 levels by 2030 and 80% below 2015 levels by 2040
Town of Truckee	GHG reductions of 80% below 2008 levels by 2040
Tuolumne County	GHG reductions of 40% below 1990 levels by 2030 and 80% below 1990 levels by 2050

Conclusion

This report provides an accounting of the City of Angels Camp's (City) community-wide and government operations greenhouse gas (GHG) emissions by source and activity. Business-as-usual (BAU) and adjusted business-as-usual (ABAU) forecasts are also provided to demonstrate the expected growth in GHG emissions, aid in assessing progress, and support GHG emissions reduction target development. These inventories set the stage for ongoing monitoring of the City's progress in achieving national, statewide, regional, and local GHG emissions reduction and other goals. It also provides analysis to inform future planning, policy development, and climate-related actions in the City. And finally, it provides practical information – including key findings, graphs, charts, and maps – that can be used by the City and other agencies to communicate needs and progress to the public, stakeholders, and policymakers.

This analysis found that in 2018, the community as a whole emitted 25,193 metric tons (MT) of CO_2e, which equates to a per capita emissions value of 6.46 MT CO_2e per year. The City's government operations emitted 511 MT of CO_2e in 2018. These are emissions sources and activities for which the City has authority to introduce and implement reduction policies. **Figures 14** and **15** below summarize the City's 2018 GHG emissions.

The City should continue to update these inventories every five years to monitor and assess progress. By conducting periodic GHG emissions inventories as data becomes more robust and methodologies improve, the City can create a clear picture of the GHG emissions in the community, and monitor and evaluate any reduction efforts taken.

Additional key findings from this analysis include:

- The largest contributor to community emissions in the inventory is community-wide transportation, which includes on-road and off-road vehicle emissions. In combination, the transportation (73.2%) and energy (22.5%) sectors produce roughly 96% of the community-wide emissions in the City, and therefore have the most potential for emissions reductions.
- The largest contributor to government operations emissions in the inventory is the vehicle fleet, which includes on-road and off-road vehicle emissions. In combination, the vehicle fleet and employee commute sectors produce more than 67% of the government operations emissions in the City, and therefore have the most potential for emissions reductions.

- The 2045 forecasts project an increase for the BAU scenario and a decrease for the ABAU scenario from the 2018 baseline. Under the BAU scenario, from 2018 to 2045 emissions are projected to increase by 12.7%. This equates to 28,378 MT CO_2e projected to be emitted in 2045. Under the ABAU scenario, emissions are projected to decrease by 28.0%, equating to 18,133 MT CO_2e projected to be emitted in 2045.
- Many cities and counties have chosen to follow California state-wide GHG reduction targets codified in Senate Bill 32, to reduce emissions to 40% below 1990 levels by 2030, or the Executive Order S-3-05, to reduce emissions to 80% below 1990 levels by 2050.

Figure 14. 2018 Community-Wide GHG Emissions

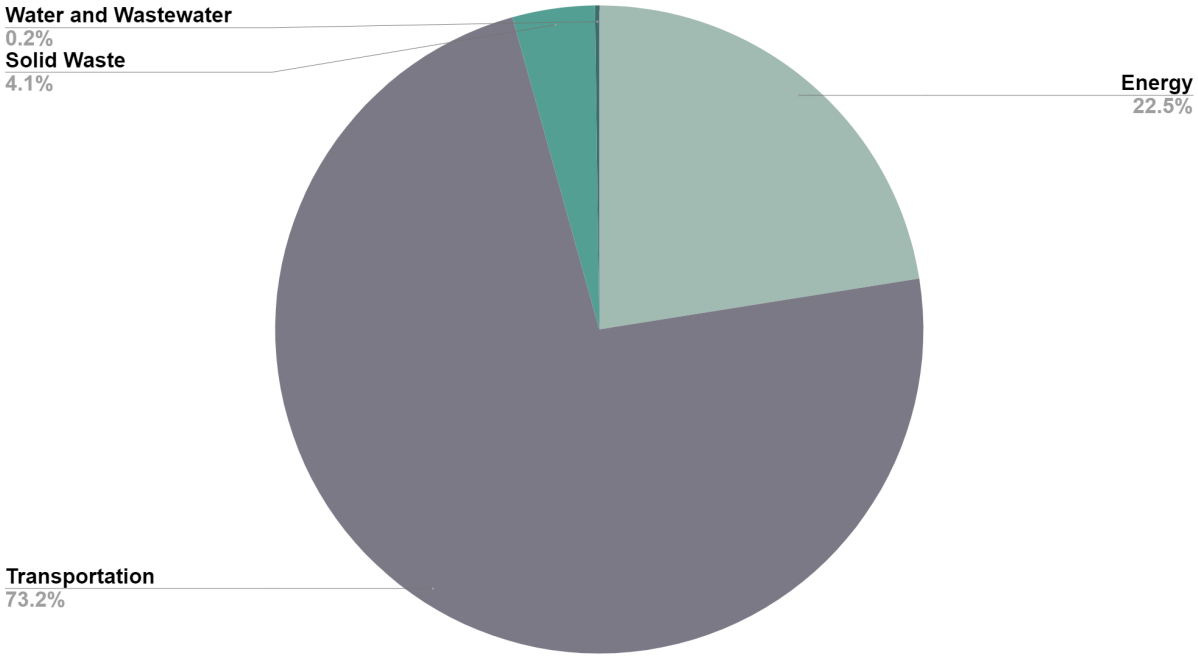
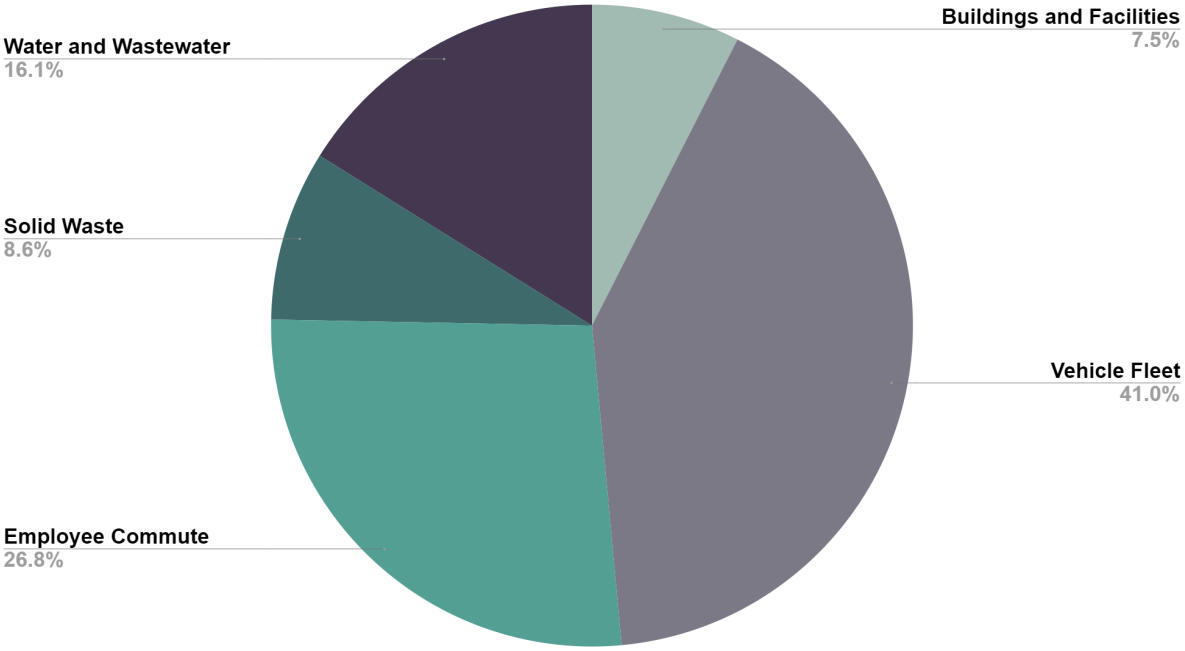


Figure 15. 2018 Government Operations GHG Emissions



Wildfire Assessment Findings

The Calaveras County and Angels Camp GHG inventories and reduction plans project also included a separate wildfire assessment report, which has been appended to this GHG inventory report. The wildfire report evaluated the challenges specific to the County, which includes the City, demonstrating how wildfires can impact the carbon cycle and GHG emissions, as well as how the wildland urban interface can both be put at risk by wildfires and increase opportunity for wildfire ignition. To understand the potential GHG emissions impact related to wildfire in the County and the City a Natural and Working Lands Carbon Inventory for the years 2010 and 2020 was developed, which demonstrates the total carbon storage in vegetation and soils. The analysis calculated the current available carbon storage (sequestration) in the County region, how carbon storage has changed over time, and highlighted regions and landcover where carbon storage value is high. Additionally, a case study was developed for the 2015 Butte Fire to analyze both the local risks for wildfire and the potential magnitude of GHG emissions and carbon storage loss from a single wildfire event. The wildfire analysis also encompassed an assessment of how forest management practices, such as thinning and prescribed burns, can significantly reduce wildfire GHG emissions and preserve long term carbon stocks that may be destroyed by high-intensity fires caused by overgrown forests.

Key findings from the wildfire assessment include:

- The 2020 Calaveras County natural and working lands total carbon stock inventories was calculated to be 74 million MT CO_2e.
- In the unlikely scenario that the majority of the deciduous and mixed forests in Calaveras County were to burn over multiple future wildfire events, the forested land has an emissions potential of over 8 million MT CO_2 from the conversion of carbon stocks to atmospheric carbon.
- Forest management can reduce the intensity and severity of wildfires in Calaveras County, reducing the GHG emissions potential per acre of forested land from 21.7 MT CO_2/acre burned down to 9.3 MT CO_2/acre burned.

The full wildfire report can be viewed in **Appendix O**, Wildfire-related Greenhouse Gas Emissions from Natural Lands Carbon Stock Loss and Climate Change Vulnerability Assessment.

GHG emissions reduction efforts require the creation of clear, actionable, and feasible implementation plans informed by local context, robust data, and proven solutions. To build upon the findings of these GHG inventories, a secondary project phase will include the development of a comprehensive GHG reduction plan for the City. This plan will develop measures to reduce emissions resulting from energy use, transportation, solid waste disposal, and treatment and transport of water and wastewater.

As the City moves forward with emissions reduction strategies and uses this data to inform planning efforts, the City should identify the benefits from strategies including: energy efficiency and conservation, renewable energy, vehicle fuel type and efficiency improvements, alternative transportation, vehicle trip reduction, land use and transit planning, waste reduction, and others. The City can achieve benefits beyond reducing emissions, including saving money, improving economic vitality, and ultimately increasing the quality of life for its residents, businesses, and visitors.

The consultant team of Sierra Business Council, Rincon Consultants, and Harris & Associates wishes to thank the project staff at the City of Angels Camp and the Calaveras Council of Governments who lent their knowledge to this project.

Appendices

Community-Wide Inventory Appendices

Appendix A. Residential Energy

Table A-1. Residential Activity Data

Activity / Source	2018	Units	Data Source
Electricity (PG&E)	13,351,915	kWh	Pacific Gas & Electric Company (PG&E)
PG&E Transmission & Distribution (T&D) Losses	640,891.92	kWh	U.S. Environmental Protection Agency eGRID (Western, CAMX, 2018)
T&D Grid Loss Factor	4.80	%	U.S. Environmental Protection Agency eGRID (Western, CAMX, 2018)
Total Electricity	**13,956,807**	**kWh**	**Data Source**
Natural Gas (PG&E)	0	Therms	Pacific Gas & Electric Company
Propane (LPG)	485,623	Gallons	U.S. Environmental Protection Agency, U.S. Energy Information Administration, and U.S. Census Bureau American Community Survey
Fuel Oil / Kerosene	0	Gallons	
Wood	31,313	MMBtu	

Methods

Utility-Derived Data

Utility-provided activity data is shown in **Table A-1**. Electricity and other stationary fuel consumption data were collected from Pacific Gas and Electric Company (PG&E), Calaveras Public Power Agency (CPPA), U.S Energy Information Administration (EIA), U.S. Census American Community Survey (ACS), and the U.S. Environmental Protection Agency eGRID (EPA eGRID) for all residences within City limits. The data was categorized as residential or non-residential and entered into ClearPath, where the GHG emissions were calculated using utility-reported and calculated grid emissions factors for electricity. The calculation methods and emissions factors are shown in **Table A-2**.

Table A-2. Residential GHG Calculation Methods & Emissions Factors

Activity / Source	Method	CO_2 lbs/MWh	CH_4 lbs/GWh	N_2O lbs/GWh	Source
2018 Electricity – PG&E	BE.2.2	206	34	4	2018 PG&E (CO_2) & 2018 U.S. EPA eGRID CAMX (CH_4 and N_2O)
2018 Electricity – CPPA	BE.2.2	40.79	0	0	2018 CPPA (Hydroelectric Project), International Hydropower Association
2018 Electricity – PG&E T&D Losses	BE.4.1	496.54	34	4	2018 U.S. EPA eGRID CAMX (CO_2, CH_4, and N_2O)
2018 Electricity – CPPA T&D Losses	BE.4.1	40.79	0	0	2018 CPPA (Hydroelectric Project), International Hydropower Association
Activity / Source	**Method**	**CO_2 lbs/MWh**	**CH_4 lbs/GWh**	**N_2O lbs/GWh**	**Source**
Natural Gas	BE.1.1	53.02 kg/MMBtu	0.005 kg/MMBtu	0.0001 kg/MMBtu	USCP Appendix C - Table B.1 and Table B.3
Propane (LPG)	BE.1.2	5.79 kg/Gallon	0.001 kg/Gallon	0.0001 kg/Gallon	USCP Appendix C - Table B.1 LPG and Table B.4 Residential LPG
Fuel Oil/Kerosene	BE.1.2	10.15 kg/Gallon	0.0015 kg/Gallon	0.0001 kg/Gallon	USCP Appendix C - Table B.1 Kerosene and Table B.4 Residential Kerosene
Wood	BE.1.2	93.80 kg/MMBtu	0.316 kg/MMBtu	0.0042 kg/MMBtu	USCP Appendix C - Table B.2 Wood and Wood Residuals and Table B.3 Biomass Fuels Solid Residential

Table A-3. 2018 Residential Non-Utility Home Heating Fuel Use Calculations (EIA/ACS)

Fuel Type	Propane	Fuel Oil / Kerosene	Wood	Data Source
California Fuel Use in 2018	263,298,000	55,44,000	21,900,000	Energy Information Administration (EIA) State Energy Data System (SEDS) 2018 California Residential Energy Use Estimates
Units	Gallons	Gallons	MMBtu	
# of 2018 California Households	419,110	31,744	205,621	U.S. Census Bureau, 2018 American Community Survey

Per Household Fuel Use	628.23	174.65	106.51	(ACS) 1-year estimates. California Households using Non-Utility Fuels for Home Heating
Units	Gallons	Gallons	MMBtu	
# of 2018 City of Angels Camp Households using Non-Utility Heating Fuels	773	0	294	U.S. Census Bureau, 2018 American Community Survey (ACS) 1-year estimates.

Non-Utility Derived Data

Non-utility activity data is shown in Table A-1. Propane and wood used in the City for home heating were estimated using EIA and ACS data. The EIA State Energy Data System California residential energy use estimates and the ACS 2018 1-year estimates of California households using non-utility fuels for home heating were used to calculate California per household fuel use. This per household fuel use factor was applied to the number of households using non-utility fuels for home heating in the City.

Table A-1 shows the activity data for home heating use. **Table A-3** above shows the EIA/ACS propane and wood for 2018. Activity data was then entered into ClearPath using the calculation methods and emissions factors shown in **Table A-2**.

Electricity Transmission and Distribution (T&D) Losses Data

Electricity transmission and distribution (T&D) losses activity data is shown in **Table A-1**. T&D losses were calculated for residential electricity following EPA guidance, using EPA eGRID region grid gross loss (ggl) factors shown in **Table A-2**. EPA recommends multiplying electricity consumption by ggl/(1-ggl). The calculated T&D losses were entered into ClearPath, where the GHG emissions were calculated using the EPA eGRID Western CAMX sub-region grid-average emissions factors.

Appendix B. Non-Residential (Commercial) Energy Use Sector Notes

Table B-1. Non-Residential Activity Data

Activity / Source	2018	Units	Data Source
Electricity (PG&E)	10,691,523	kWh	Pacific Gas & Electric Company (PG&E)
Electricity (CPPA)	1,399,724	kWh	Calaveras Public Power Agency (Hydroelectric Project)

PG&E T&D Losses	513,193	kWh	U.S. Environmental Protection Agency eGRID (Western, CAMX, 2018)
CPPA T&D Losses	67,187	kWh	U.S. Environmental Protection Agency eGRID (Western, CAMX, 2018)
T&D Grid Loss Factor	4.80	%	U.S. Environmental Protection Agency eGRID (Western, CAMX, 2018)
Total Electricity		**kWh**	**Data Source**
Natural Gas (PG&E)	0	Therms	Pacific Gas & Electric Company
Propane (LPG)	9,736	Gallons	U.S. Environmental Protection Agency, U.S. Energy Information Administration, and U.S. Census Bureau American Community Survey

Methods

Utility-Derived Data

Utility-provided activity data is shown in **Table B-1**. Electricity, natural gas and other stationary fuel consumption data were collected from Pacific Gas and Electric Company (PG&E), Calaveras Public Power Agency (CPPA), and the U.S. Environmental Protection Agency eGRID (EPA eGRID) for all commercial facilities within City limits. The activity data was entered into ClearPath, where the GHG emissions were calculated using utility and EPA reported grid emissions factors. The calculation methods and emissions factors are shown in **Table B-2**.

Table B-2. Non-Residential GHG Calculation Methods & Emissions Factors

Activity / Source	Method	CO_2 lbs/MWh	CH_4 lbs/GWh	N_2O lbs/GWh	Source
2018 Electricity – PG&E	BE.2.2	206	34	4	2018 PG&E (CO_2) & 2018 U.S. EPA eGRID CAMX (CH_4 and N_2O)
2018 Electricity – CPPA	BE.2.2	40.79	0	0	2018 CPPA (Hydroelectric Project), International Hydropower Association
2018 Electricity – PG&E T&D Losses	BE.4.1	496.54	34	4	2018 U.S. EPA eGRID CAMX (CO_2, CH_4, and N_2O)
2018 Electricity – CPPA T&D Losses	BE.4.1	40.79	0	0	2018 CPPA (Hydroelectric Project), International Hydropower Association

Activity / Source	Method	CO_2 lbs/MWh	CH_4 lbs/GWh	N_2O lbs/GWh	Source
Natural Gas	BE.1.1	53.02 kg/MMBtu	0.005 kg/MMBtu	0.0001 kg/MMBtu	USCP Appendix C - Table B.1 and Table B.3
Propane (LPG)	BE.1.2	5.79 kg/Gallon	0.001 kg/Gallon	0.0001 kg/Gallon	USCP Appendix C - Table B.1 LPG and Table B.4 Residential LPG

Table B-3. 2018 Non-Residential Non-Utility Heating Fuel Use Calculations (EIA)

Activity / Source	Propane Data	Data Source
U.S. Propane Use	1,923,497,268	Energy Information Administration (EIA) 2018 U.S. Commercial Energy Use Estimates (SEDS)
Units	Gallons	
2018 U.S. Commercial Square Footage	97,000,000,000	Energy Information Administration (EIA) 2018 Commercial Square Footage Estimates (CBECS)
Per Square Foot Use	0.0198	
Units	Gallons	
2018 City of Angels Camp Commercial Square Footage	490,969	City of Angels Camp

Non-Utility Derived Data

Propane is widely used throughout the City for heating purposes. Propane data was estimated using commercial propane usage data and commercial square footage data from the EIA. This data was then scaled using commercial square footage within the City and is shown in **Table B-3**.

Electricity Transmission and Distribution (T&D) Losses Data

Electricity transmission and distribution (T&D) losses activity data is shown in **Table B-1**. T&D losses were calculated for commercial electricity following EPA guidance, using EPA eGRID region grid gross loss (ggl) factors shown in **Table B-2**. EPA recommends multiplying electricity consumption by ggl/(1-ggl). The calculated T&D losses were entered into ClearPath, where the GHG emissions were calculated using the EPA eGRID Western CAMX sub-region grid-average emissions factors.

Appendix C. Community Transportation Sector Notes

Table C-1. Community Transportation Activity Data

On-Road Activity / Source (Scaled)	Vehicle Miles Traveled (VMT)	Data Source
Gasoline Vehicles	29,915,729	Calaveras Council of Governments (CCOG) U.S. Census Bureau Population Data (for Population Scaling) California Air Resources Board (CARB) EMFAC 2017
Diesel Vehicles	4,825,165	
Electric Vehicles	41,507	
Natural Gas Vehicles	7,092	
Plug-In Hybrid Vehicles	148,365	
Total City of Angels Camp Annual VMT	34,937,859	
EMFAC City of Angels Camp VMT	109,494	

Off-Road Vehicles (Scaled) Direct ClearPath Input	Unit	Data Source
1,182	CO_2 (Metric Tons)	CARB OFFROAD 2017, U.S EPA Emissions Factors, and IPCC 5th Assessment Global Warming Potential
0.13	CH_4 (Metric Tons)	
0.053	N_2O (Metric Tons)	

Table C-2. Community Transportation GHG Calculation Methods & Emissions Factors

Activity / Source	Method	CO_2	CH_4	N_2O	Emissions Factor Source
Gasoline Vehicles (g/mile)	TR.1.B	420.20	0.0164	0.0184	CARB EMFAC 2017
Diesel Vehicles (g/mile)	TR.1.B	889.75	0.0130	0.14	
Electric Vehicles (g/mile)	TR.1.B	0	0	0	
Natural Gas Vehicles (g/mile)	TR.1.B	990.45	0.5803	0.2019	
Plug-In Hybrid Vehicles (g/mile)	TR.1.B	165.04	0.0006	0.00075	

Methods

On-Road Vehicles

On-road transportation emissions for the City were calculated using vehicle miles traveled (VMT) estimated by Calaveras Council of Governments' Travel Demand Model and EMFAC2017 data for the County, which was scaled to the City using population data. The CCOG analysis included all miles traveled within the County in 2018, as well as trips that started in boundary and ended out of boundary and trips that started out of boundary and ended in boundary. On-road transportation activity data is shown in **Table C-1**. Activity data was entered into ClearPath, where City-level fuel and vehicle-specific emissions factors, shown in **Table C-2**, were applied to calculate the GHG emissions associated with community on-road transportation. The methodology for collecting and conditioning this data is as follows:

Fuel / Vehicle Type Breakdown and Emissions Calculations

VMT and emissions percentages by fuel type are estimated for the County using the CARB's EMFAC 2017 model, run for 2018 and scaled to the City using population. Data from this model was used to derive county-specific per-mile emissions factors and vehicle fuel efficiencies for gas, diesel, natural gas, hybrid, and electric fuels for passenger cars, light-duty trucks and heavy-duty trucks. These were applied to the City's VMT estimates to derive emissions by fuel type.

EMFAC 2017 reports CO_2, CH_4, and N_2O emissions factors for different vehicle type and fuel combinations for every county in California, informed by California Department of Motor Vehicles registrations, the Smog Check program and other data sources. Average CO_2, CH_4, and N_2O emissions factors were calculated for passenger vehicles, light trucks, and heavy trucks.

Off-Road Emissions

Off-road emissions for the City were obtained from the California Air Resources Board's (CARB) OFFROAD 2017 model. Included were emissions attributed to off-road, fuel-consuming equipment categories including Industrial, Light Commercial, and Construction vehicles. These are equipment types that are thought to have significant operation within the County and were scaled to the City using population. Emissions data, shown in **Table C-1**, was entered into ClearPath.

Appendix D. Community Solid Waste Sector Notes

Table D-1. Community Solid Waste Activity Data

Landfill	2018 Waste Generation (Tons)	Landfill Gas Capture?	2018 Distance to Facility (Miles)	Data Source
Forward Landfill	1,056	Yes	55.10	Calaveras County Integrated Waste Management, CalRecycle, and Google Maps
Rock Creek Landfill	2,463	Yes	32.10	

Table D-2. Community Solid Waste GHG Calculation Methods & Emissions Factors

Activity / Source	Method	Type	Emissions Factor	Emissions Factor Source
Transportation of Solid Waste	SW.6	Solid Waste Transportation	0.00014 Metric Tons CO_2e / Wet Short Ton / Mile	USCP Appendix E

Activity / Source	Method	Type	%	Metric Tons CH_4 / Wet Short Ton	Emissions Factor Source
Community-Generated Solid Waste Characterization	12.2.2	Newspaper	1.20	0.043	CalRecycle Calaveras County Waste Characterization Study for 2018 USCP Appendix E
		Office Paper	1.80	0.203	
		Corrugated Cardboard	5.20	0.120	
		Magazines/Third Class Mail	8.40	0.049	
		Food Scraps	18.20	0.078	
		Grass	1.15	0.038	
		Leaves	2.70	0.013	
		Branches	3.05	0.062	
		Dimensional Lumber	23.70	0.062	
		All Other (Non-Organic)	34.60	0	

Methods

Community-Generated Solid Waste

Solid waste generated in the City of Angels Camp and disposed of in landfills emits GHGs. Emissions reported for 2018 occur at the landfills over the entire period that waste decomposes, estimated to be 100 years. The tonnage of landfilled waste generated by City residents, businesses, and visitors was collected from the Calaveras County Integrated Waste Management and scaled to the City using population.

Waste characterization percentages from CalRecycle, shown in **Table D-2**, were applied to the tonnage of community-generated waste that was landfilled. The waste tonnage and characterization data were entered into ClearPath, where GHG emissions were calculated based on standard factors for organic content and methane-generating potential for each waste type. Emissions were adjusted based on the presence of landfill gas capture systems.

Solid Waste Transportation

Solid waste transportation emissions include emissions from the trucks used to transport the waste to the regional landfills. The tonnage of waste collected and the distance to the landfills were entered into ClearPath to calculate GHG emissions using default per-ton-mile CO_2e emissions (the GHGs emitted to transport one ton of waste one mile).

It is important to acknowledge the benefits of recycling and composting that lower waste volumes and emissions. When waste volumes are reduced, transportation emissions are likewise reduced, and when incoming organic waste is diverted, landfill emissions are also reduced. Finally, upstream emissions from materials manufacturing are reduced when recycled materials displace virgin materials.

Appendix E. Community Potable Water Use Sector Notes

Table E-1. Community Potable Water Electricity Use Activity Data - Information Item

Year	Service	Electricity Use (kWh)	Potable Water Provided (Gallons)	Energy Intensity (kWh / Million Gallons)	Population Served	Data Source
2020	CPPA	197,600	321,800,000	614.05	3,875	USCP, City of Angels Camp

Table E-2. Community Potable Water GHG Calculation Methods & Emissions Factors

Activity / Source	Method	CO_2 lbs/MWh	CH_4 lbs/GWh	N_2O lbs/GWh	Emissions Factor Source
2018 Electricity - CPPA	BE.2.2	40.79	0	0	2018 CPPA (Hydroelectric Project), International Hydropower Association

Methods

Community Potable Water Electricity Use

The City's potable water use activity data is shown in **Table E-1**. Data was collected from the City of Angels Camp. Even though the wastewater treatment plant is located outside of City limits, it is included in this analysis because it is owned and operated by the City. The electricity use was marked as an "information only" item to prevent double counting. The electricity use was entered into ClearPath, where the GHG emissions were calculated using relevant emissions factors for electricity shown in **Table E-2**. T&D losses were calculated by applying the EPA eGRID grid loss factors to the electricity used and then entering the loss into ClearPath, where the GHG emissions were calculated using the relevant emissions factors. All of this data was marked as "information only" to prevent double counting.

Appendix F. Community Wastewater Treatment Sector Notes

Table F-1. Community Wastewater Treatment Electricity Use Activity Data - Information Item

Year	Service	Electricity Use (kWh)	Water Treated (Gallons)	Energy Intensity (kWh / Million Gallons)	Population Served	Data Source
2020	CPPA	1,400,000	168,000,000	8,333	3,875	USCP, City of Angels Camp

Table F-2. Community Wastewater Treatment GHG Calculation Methods & Emissions Factors

Activity / Source	Method	CO_2 lbs/MWh	CH_4 lbs/GWh	N_2O lbs/GWh	Emissions Factor Source
2018 Electricity – CPPA	BE.2.2	40.79	0	0	2018 CPPA (Hydroelectric Project), International Hydropower Association
Activity / Source	**Method**	**CO_2**	**CH_4**	**N_2O**	**Emissions Factor Source**
Central Plants - with Nitrification / Denitrification (Population-Based)	WW.7	N/A	N/A	7 g N_2O / person / year	USCP Appendix F
Central Plants - without Nitrification / Denitrification (Population-Based)	WW.8	N/A	N/A	3.2 g N_2O / person / year	USCP Appendix F
Effluent (Population-Based)	WW.12	N/A	N/A	0.005 kg N_2O-N/kg sewage-N discharged	USCP Appendix F
Lagoons - No Primary Treatment (Population-Based)	WW.6	N/A	0.6 kg CH_4 / kg BOD_5	N/A	USCP Appendix F
Septic Systems (Population-Based)	WW.11	N/A	0.6 kg CH_4 / kg BOD_5	N/A	USCP Appendix F

Methods

Community Wastewater Treatment Electricity Use

Community-generated wastewater treatment activity data for 2018 is shown in **Table F-1**. Data on electricity use, wastewater treated, and population served by the plants and systems were collected from City staff and Calaveras County Public Power Agency (CPPA). Because the wastewater treatment infrastructure lies within the City, the electricity use is marked as "information only" to prevent double counting. The electricity use was entered into ClearPath, where the GHG emissions were calculated using utility-reported grid emissions factors for electricity shown in **Table F-2.** T&D losses were calculated by applying the EPA eGRID regional grid loss factors to the total electricity use and then entered into

ClearPath, where the GHG emissions were calculated using the EPA eGRID Western CAMX sub-region grid average emissions factors. All of this data was marked as "information only" to prevent double counting.

Table F-3. Community Wastewater Treatment Operations Activity Data

2018 Facility	Wastewater Treated (MG)	Population Served	Commercial / Industrial Factor	Nitrification / Denitrification?	Aerobic?	Data Source
City of Angels Camp	168	3,875	1	Yes	Yes	City of Angels Camp

Community Wastewater Treatment Facility Process and Fugitive Emissions

There are two emissions associated with wastewater treatment processes: methane (CH_4) and nitrous oxide (N_2O), which together account for a small part of total community-based GHG emissions. Calculating the makeup and amount of emissions depends on the processes involved and the management practices employed.

City wastewater treatment is operated by one central treatment facility. Operational parameters of the wastewater treatment systems are delineated in **Table F-3**. The plant is aerobic with nitrification / denitrification nutrient-removal systems. The wastewater treatment activity data were entered into ClearPath, where GHG emissions were calculated using the standard methods and emissions factors from the United States Community Protocol (USCP) and Local Government Operations Protocol (LGOP) that are shown in **Table F-2**.

Uncertainties

According to the EPA national inventory of greenhouse gas emissions, considerable uncertainty exists within any of the EPA/IPCC-based methodologies used to estimate wastewater process and fugitive emissions. EPA states that population-based methane emissions could be underestimated by 37% or overestimated by 47% while nitrous oxide emissions could be underestimated by 76% or overestimated by 93%. Emissions estimates based on direct source measurements can possibly have higher accuracy and less uncertainty. This extreme degree of uncertainty exists because these methodologies were originally developed for international countrywide inventories that were mainly population-based. By necessity, these methodologies were generalized "top-down"

approaches that sought to provide emissions estimates for countries where detailed information would be impractical to obtain. Although these methodologies had the advantage of being relatively simple to calculate, the trade-off was a compromised level of accuracy. Nevertheless, the methodologies in this Appendix reflect the evolution of knowledge since the development of the LGOP and rely upon direct measurement where possible.

Methods are evolving but especially where the emissions are based on population and default inputs, communities should exercise caution in drawing conclusions or establishing policies based on these calculations.

Government Operations Inventory Appendices

Appendix G. Buildings and Facilities Sector Notes

Table G-1. Buildings and Facilities Electricity and Natural Gas Activity Data

Building / Facility	Activity / Source	kWh	Unit	Source
City of Angels Camp Facilities	Electricity (PG&E)	66,725	kWh	Pacific Gas & Electric Company (PG&E)
City of Angels Camp Facilities	Electricity (CPPA)	1,399,724	kWh	Calaveras Public Power Agency (CPPA)
City of Angels Camp Facilities	Propane	1,073	gallons	EIA

Table G-2. Buildings and Facilities GHG Calculation Methods & Emissions Factors

Activity / Source	Method	CO_2 lbs/MWh	CH_4 lbs/GWh	N_2O lbs/GWh	Source
2018 Electricity – PG&E	6.2	206	34	4	2018 PG&E (CO_2) & 2018 U.S. EPA eGRID CAMX (CH_4 and N_2O)
2018 Electricity – CPPA	6.2	40.79	0	0	2018 CPPA (Hydroelectric Project), International Hydropower Association

Activity / Source	Method	CO_2 lbs/MWh	CH_4 lbs/GWh	N_2O lbs/GWh	Source
Natural Gas	BE.1.1	53.02 kg/MMBtu	0.005 kg/MMBtu	0.0001 kg/MMBtu	USCP Appendix C - Table B.1 and Table B.3
Propane (LPG)	BE.1.2	5.79 kg/Gallon	0.001 kg/Gallon	0.0001 kg/Gallon	USCP Appendix C - Table B.1 LPG and Table B.4 Residential LPG

Methods

Buildings and facilities electricity and propane data, shown in **Table G-1**, was collected from Pacific Gas & Electric Company, Calaveras Public Power Agency, and the U.S. Energy Information Administration. The propane data was scaled to City facility square footage using estimates from national commercial energy use and national commercial square footage data. The activity data was entered into ClearPath, where GHG emissions were calculated using the calculation methods and emissions factors shown in **Table G-2**.

Appendix H. Vehicle Fleet Sector Notes

Table H-1. Vehicle Fleet Activity Data

Activity / Source On-Road Unless Noted Off-Road	Total Fuel Use (Gallons)	Annual Miles Traveled (VMT)	VMT % Passenger Vehicles	VMT % Light Trucks	VMT % Heavy Trucks	Data Source
Gasoline Vehicles	10,905	185,102	48.62	48.85	2.53	City of Angels Camp (Public Works, Police, and Fire Departments)
Diesel Vehicles	5,849	49,144	0	13.86	86.14	
Off Road Gasoline	39.00	N/A	N/A	N/A	N/A	
Off Road Diesel	5,186	N/A	N/A	N/A	N/A	

Table H-2. Vehicle Fleet GHG Calculation Methods & Emissions Factors

Activity / Source	Method	CO_2 kg / gallon	CH_4 grams / mile	N_2O grams / mile	Emissions Factor Source
On-Road Passenger Gasoline	7.1.1.1 and 7.1.3.3	8.78	0.0186	0.0093	LGOP Appendix G - Table G.11 (CO_2) and U.S. National Transportation Defaults (CH_4 and N_2O)
On-Road Light Trucks Gasoline	7.1.1.1 and 7.1.3.3	8.78	0.0201	0.0167	

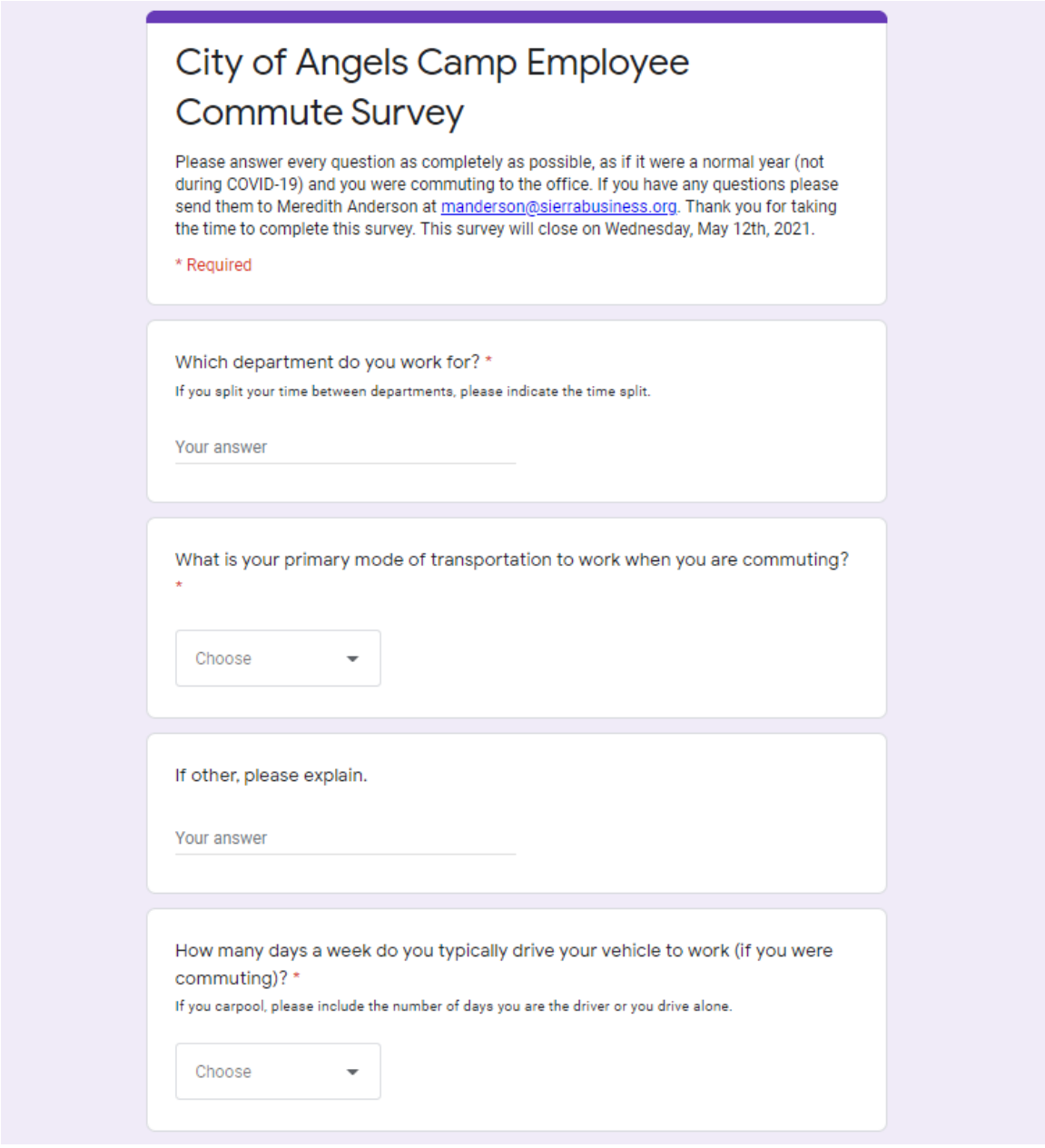
On-Road Heavy Trucks Gasoline	7.1.1.1 and 7.1.3.3	8.78	0.086	0.0664	
On-Road Passenger Diesel	7.1.1.1 and 7.1.3.3	10.21	0.0005	0.001	
On-Road Light Trucks Diesel	7.1.1.1 and 7.1.3.3	10.21	0.001	0.0015	
On-Road Heavy Trucks Diesel	7.1.1.1 and 7.1.3.3	10.21	0.0051	0.0048	
Off-Road Large Utility Diesel	7.1.1.1 and 7.2	10.21	0.58 grams / gallon		LGOP Appendix G - Table G.11 (CO_2) & G.14 (CH_4 and N_2O)

Methods

The 2018 vehicle fleet information, including vehicles miles traveled (VMT) and fuel use (by type and department) was collected from City staff. Vehicle fleet-specific 2018 miles per gallon (MPG) data was used to calculate annual mileage and fuel use for each vehicle. Vehicle breakdown and fuel use were entered into ClearPath.

Appendix I. Employee Commute Sector Notes

Figure I-1. Employee Commute Survey



City of Angels Camp Employee Commute Survey

Please answer every question as completely as possible, as if it were a normal year (not during COVID-19) and you were commuting to the office. If you have any questions please send them to Meredith Anderson at manderson@sierrabusiness.org. Thank you for taking the time to complete this survey. This survey will close on Wednesday, May 12th, 2021.

* Required

Which department do you work for? *

If you split your time between departments, please indicate the time split.

Your answer

What is your primary mode of transportation to work when you are commuting? *

Choose

If other, please explain.

Your answer

How many days a week do you typically drive your vehicle to work (if you were commuting)? *

If you carpool, please include the number of days you are the driver or you drive alone.

Choose

How many days a week do you typically work? *

Choose

What is the average number of vacation days, sick days, holidays and office closures (combined) you observe in a typical YEAR? *

Please enter the number not including weekends.

Your answer

When you drive your own vehicle to work, What is the one-way distance on your commute? *

Please enter a whole number. Enter mileage for one direction only.

Your answer

If you drive to work, what type of vehicle do you drive?

Choose

What is the make and model of your vehicle?

Your answer

What is the model year of your vehicle?

Your answer

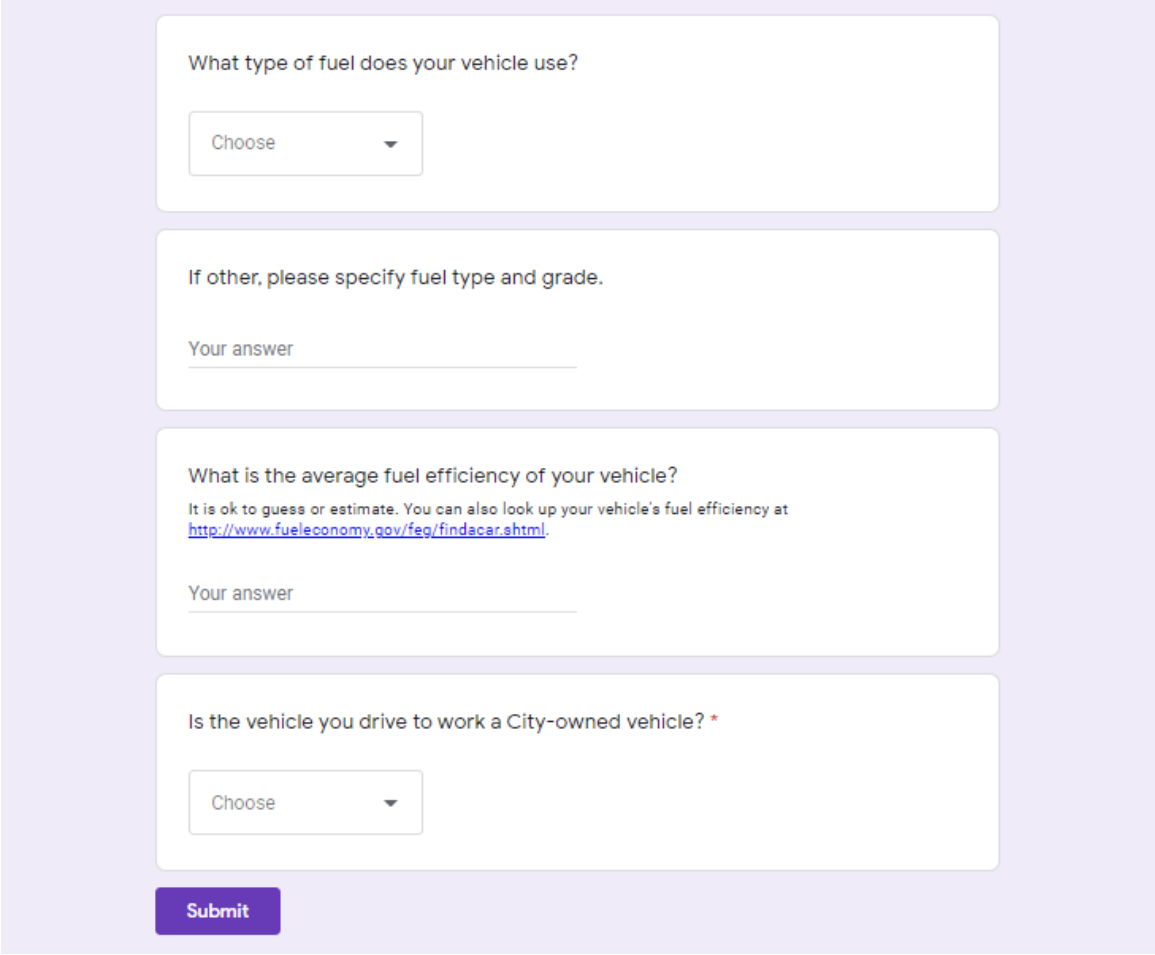


Table I-1. Employee Commute Activity Data

Fuel	Vehicle Type	2018 Vehicle Miles Traveled	%	Data Source
Number of Employees	N/A	40	N/A	City of Angels Camp
Gasoline	Passenger Cars	254,250	49.73	City of Angels Camp, 2021 Employee Commute Surveys
	Light Trucks		50.27	
	Heavy Trucks		0	
Diesel	Passenger Cars	49,271	10.23	
	Light Trucks		89.77	
	Heavy Trucks		0	
Total	**All Types**	**303,521**	**N/A**	

Table I-2: Employee Commute GHG Calculation Methods & Emissions Factors

Activity / Source	Method	CO_2 kg / gallon	CH_4 grams / mile	N_2O grams / mile	Emissions Factor Source
Passenger Vehicles - Gasoline	7.1.1.1 and 7.1.3.3	8.78	0.0186	0.0093	LGOP Appendix G - Table G.11 (CO_2) and U.S. National Transportation Defaults (CH_4 and N_2O)
Light Trucks - Gasoline		8.78	0.0201	0.0167	
Heavy Trucks - Gasoline		8.78	0.086	0.0664	
Passenger Vehicles - Diesel		10.21	0.0005	0.001	
Light Trucks - Diesel		10.21	0.001	0.0015	
Heavy Trucks - Diesel		10.21	0.0051	0.0048	

Methods

Employee commute emissions were calculated using employee surveys conducted in 2021 to use as a proxy for the year 2018. There were 40 respondents out of the 40 total employees. The survey collected information regarding travel distances, modes, and frequency. Business travel is not delineated in the surveys, but emissions from business travel in City vehicles is captured in the Vehicle Fleet sector. The VMT activity data, shown in **Table I-1**, was then entered into ClearPath, where GHG emissions were calculated using the methods and emissions factors shown in **Table I-2**. The fuel efficiencies were used to convert VMT to fuel use for the emissions calculations.

Appendix J. Solid Waste Sector Notes

Table J-1. Government Operations Solid Waste Activity Data

Landfill Name	2018 Wet Tons	Density (lbs / Cubic Yard)	Data Source
Forward Landfill	22	194.5	City of Angels Camp
Rock Creek Landfill	51.34	194.5	
Total Government Operations Waste	**73.34**		

Table J-2. Solid Waste Calculation Methods & Emissions Factors

Activity / Source	Method	Type	Emissions Factor	Emissions Factor Source
Transportation of Solid Waste	SW.6	Solid Waste Transportation	0.00014 Metric Tons CO_2e / wet short ton / mile	USCP Appendix E

Activity / Source	Method	Type	%	Metric Tons CH_4 / Wet Short Ton	Percentages and Emissions Factor Source
Government Operations Solid Waste Characterization	12.2.2	Newspaper	2.59	0.043	CalRecycle Calaveras County Public Administration 2018 Waste Characterization Study
		Office Paper	27.80	0.203	
		Corrugated Cardboard	4.70	0.120	
		Magazines / Third Class Mail	5.47	0.049	
		Food Scraps	14.60	0.078	
		Grass	1.35	0.038	
		Leaves	1.35	0.013	LGOP Chapter 12
		Branches	0.04	0.062	
		Dimensional Lumber	14.12	0.062	USCP Appendix E
		All Other (Non-Organic)	27.98	0	

Methods

The City facility-generated solid waste data was collected from City staff in the form of cubic yards. The tonnage of solid waste, shown in **Table J-1**, was calculated using a density of 89 lbs per cubic yard, provided by the California Integrated Waste Management Board (CalRecycle) specifically tailored to public administration waste, and 300 lbs per cubic yard for community-generated waste. The average of these two values was used (194.5 lbs per cubic yard), as some of the waste was generated from community facilities where the City pays for the solid waste disposal. The solid waste was transferred to managed landfills for disposal, which have landfill-gas capture systems in place. The emissions associated with this waste occur at the landfill sites over the entire period of decomposition (estimated to be about 100 years).

The solid waste tonnage activity data was entered into ClearPath, where GHG emissions were calculated using CalRecycle's public administration and City-wide percentages, coupled with standard emissions factors adopted by the California Air Resources Board, the California Climate Action Registry, ICLEI - Local Governments for Sustainability and The Climate Registry and shown in **Table J-2**.

Appendix K. City Operations Potable Water Electricity Use

Table K-1. City Operations Potable Water Electricity Use Activity Data

Year	Service	Electricity Use (kWh)	Potable Water Provided (Gallons)	Energy Intensity (kWh / Million Gallons)	Population Served	Data Source
2020	CPPA	197,600	321,800,000	614.05	3,875	USCP, City of Angels Camp

Table K-2. City Operations Potable Water GHG Calculation Methods & Emissions Factors

Activity / Source	Method	CO_2 lbs/MWh	CH_4 lbs/GWh	N_2O lbs/GWh	Emissions Factor Source
2018 Electricity - CPPA	BE.2.2	40.79	0	0	2018 CPPA (Hydroelectric Project), International Hydropower Association

Methods

City Operations Potable Water Electricity Use

The City's potable water use activity data is shown in **Table K-1**. Data was collected from the City of Angels Camp. Even though the treatment plant is located outside of City limits, it is included in this analysis because it is owned and operated by the City. The electricity use was entered into ClearPath, where the GHG emissions were calculated using relevant emissions factors for electricity shown in **Table K-2**.

Appendix L. City Operations Wastewater Treatment Sector Notes

Table L-1. City Operations Wastewater (WW) Electricity Use Activity Data

Year	Service	Electricity Use (kWh)	Water Treated (Gallons)	Energy Intensity (kWh / Million Gallons)	Population Served	Data Source
2020	CPPA	1,400,000	168,000,000	8,333	3,875	USCP, City of Angels Camp

Table L-2. Energy Use GHG Calculation Methods & Emissions Factors

Activity / Source	Method	CO_2 lbs/MWh	CH_4 lbs/GWh	N_2O lbs/GWh	Emissions Factor Source
2018 Electricity – CPPA	BE.2.2	40.79	0	0	2018 CPPA (Hydroelectric Project), International Hydropower Association

Activity / Source	Method	CO_2	CH_4	N_2O	Emissions Factor Source
Central Plants - with Nitrification / Denitrification (Population-Based)	WW.7	N/A	N/A	7 g N_2O / person / year	USCP Appendix F
Central Plants - without Nitrification / Denitrification (Population-Based)	WW.8	N/A	N/A	3.2 g N_2O / person / year	USCP Appendix F
Effluent (Population-Based)	WW.12	N/A	N/A	0.005 kg N_2O-N/kg sewage-N discharged	USCP Appendix F
Lagoons - No Primary Treatment (Population-Based)	WW.6	N/A	0.6 kg CH_4 / kg BOD_5	N/A	USCP Appendix F
Septic Systems (Population-Based)	WW.11	N/A	0.6 kg CH_4 / kg BOD_5	N/A	USCP Appendix F

Table L-3. City Operations Wastewater Treatment Facility Data

2018 Facility	Wastewater Treated (MG)	Population Served	Commercial / Industrial Factor	Nitrification / Denitrification?	Aerobic?	Data Source
City of Angels Camp	168	3,875	1	Yes	Yes	City of Angels Camp

Methods

Wastewater Treatment Energy Use

Wastewater treatment activity data for 2018 is shown in **Table L-1**. Data on electricity use and water volumes were collected from City staff. Transmission and distribution losses were calculated by applying the EPA eGRID regional grid loss factors to the total electricity use and then entered into ClearPath, where the GHG emissions were calculated using the EPA eGRID Western CAMX sub-region grid average emissions factors. This data was marked as "information only" to prevent double counting.

Wastewater Treatment Facility Process and Fugitive Emissions

City wastewater treatment is operated by one central treatment facility. Operational parameters of the wastewater treatment systems are delineated in **Table L-3**. The plant is aerobic with nitrification / denitrification nutrient-removal systems. The wastewater treatment activity data were entered into ClearPath, where GHG emissions were calculated using the standard methods and emissions factors from the United States Community Protocol (USCP) and Local Government Operations Protocol (LGOP) that are shown in **Table L-2**.

Forecast Data & Growth Rate Appendices

Appendix M. Forecast

Methods

BAU projections are intended to demonstrate the expected growth in GHG emissions if no reduction measures are taken. The BAU forecast is beneficial in that it allows for comparison between forecasted and actual observed emissions to determine what emissions reduction progress has been made to date, as well as to assess whether or not

future reduction goals could be met by the reduction efforts made to date. BAU forecast estimates future community-wide GHG emissions in the years 2030, 2035, and 2045. A BAU forecast is based on two inputs — current emissions data and growth rates. Baseline emissions data came from the 2018 inventory. Growth rates were calculated based on projected growth of relevant indicator variables.

An adjusted scenario forecast, or adjusted BAU (ABAU), accounts for legislative adjustments and projected emissions reductions resulting from legislative action. This includes future updates to statewide vehicle fleet standards and renewable portfolio standards. ABAU forecasts are developed using two inputs — current emissions data and either BAU projections or adjusted rates of growth or decay.

Calculating the emissions forecast is achieved by isolating an indicator variable for the various sectors and sub-sectors that were evaluated in the inventory and then assess how that indicator variable is projected to increase or decrease into the future and apply that rate of change to the emissions from that sector or sub-sector.

For example, agricultural emissions forecasts are based on projecting forward current trends in agricultural activities. This includes the number of livestock and crop production acreage as provided in recent Calaveras County Agriculture Production Reports. The previous ten years of reported data were used to develop growth factors for the emissions forecast. A slight growth in acres of farmland was shown and a growth rate was calculated. Additionally, livestock numbers show no evidence of trend over the 10 year period between 2010 and 2019. Accordingly, livestock population was assumed to remain constant through the emissions forecast period. The forecast was developed out to 2045 using a number of indicator variables for different sectors and subsectors to arrive at our BAU forecast. This process was applied to each sector and sub-sector.

For the City forecasts, two different scenarios were included for both BAU and ABAU forecasts in order to paint a more holistic picture of what might happen in the County in the future. For both BAU and ABAU forecasts, there are two different scenarios: a growth scenario that is aligned with the 2019 Calaveras County General Plan (General Plan)[38], using 2018 California Department of Finance (DOF) data[39], and a declining growth scenario that uses current 2021 DOF population projections (as of this report, pulled in June 2021). The 2018 projection data with a population growth resulted in increasing emissions for BAU forecast and decreasing emissions for the ABAU forecast. The 2021 projection data with a

[38] Calaveras County General Plan. (2019). Calaveras County.
[39] Projections. (2021). California Department of Finance.

population decline resulted in decreasing emissions for BAU forecast and decreasing emissions for the ABAU forecast.

Sierra Business Council (SBC) also investigated the Regional Housing Needs Allocation[40], through California's Department of Housing and Community Development (HCD). HCD is based off of DOF population projection data, where the values from the 2018 Housing Element were most likely pulled from 2017 DOF population projection data and HCD applied an adjusted DOF population value. SBC also discovered and resolved discrepancies among DOF projections across different data sets, resulting in the DOF instructing us to use P2A population projections.

The project clients (CCOG and Calaveras County) and the consultants determined using the 2018 DOF population projection data may likely yield the most representative forecast scenario. It is the closest data set that aligns to the General Plan.

The rate of change for the Calaveras County VMT projections was applied to the on-road transportation sector. We did not use DOF household data for any of the sectors in the forecast scenarios. As the household projection rate is similar to the population projection rate, we felt comfortable applying the population projection rate in lieu of the household projection rate. The sources for all of the growth rate indicators are located in **Tables N-1** and **N-2**.

Table M-1. Greenhouse Gas Emissions Forecast Data for Business-as-Usual Forecast (2021 California Department of Finance Population Projections)

Year	Residential Energy	Non-Residential Energy	Transportation	Solid Waste	Water and Wastewater	Total Emissions
2018	4,459	1,207	18,437	1,037	52.78	25,193
2019	4,442	1,214	18,523	1,033	52.58	25,265
2020	4,431	1,221	18,611	1,030	52.44	25,346
2021	4,417	1,228	18,699	1,027	52.28	25,423
2022	4,417	1,235	18,790	1,027	52.28	25,521
2023	4,424	1,242	18,883	1,029	52.37	25,630
2024	4,434	1,249	18,976	1,031	52.49	25,744
2025	4,446	1,256	19,071	1,034	52.63	25,860
2026	4,457	1,263	19,165	1,037	52.76	25,974

[40] Calaveras Final Regional Housing Need Determination. (2018). California Department of Housing and Community Development.

2027	4,470	1,270	19,259	1,040	52.90	26,091
2028	4,484	1,277	19,354	1,043	53.08	26,211
2029	4,490	1,284	19,446	1,044	53.14	26,318
2030	4,494	1,291	19,539	1,045	53.19	26,422
2031	4,505	1,298	19,633	1,048	53.32	26,537
2032	4,510	1,305	19,725	1,049	53.39	26,643
2033	4,512	1,312	19,817	1,049	53.41	26,744
2034	4,513	1,319	19,908	1,050	53.41	26,842
2035	4,511	1,326	19,998	1,049	53.39	26,938
2036	4,512	1,333	20,090	1,049	53.41	27,038
2037	4,508	1,340	20,180	1,048	53.35	27,129
2038	4,503	1,347	20,270	1,047	53.30	27,220
2039	4,492	1,354	20,358	1,045	53.16	27,301
2040	4,488	1,361	20,448	1,044	53.12	27,394
2041	4,473	1,368	20,535	1,040	52.94	27,469
2042	4,465	1,375	20,624	1,038	52.85	27,555
2043	4,454	1,382	20,712	1,036	52.72	27,636
2044	4,448	1,389	20,801	1,034	52.64	27,725
2045	4,439	1,396	20,890	1,032	52.54	27,809

Table M-2. Greenhouse Gas Emissions Forecast Data for Business-as-Usual Forecast (2018 California Department of Finance Population Projections)

Year	Residential Energy	Non-Residential Energy	Transportation	Solid Waste	Water and Wastewater	Total Emissions
2018	4,459	1,207	18,437	1,037	52.78	25,193
2019	4,471	1,214	18,531	1,040	52.92	25,308
2020	4,485	1,221	18,626	1,043	53.09	25,428
2021	4,502	1,228	18,721	1,047	53.29	25,552
2022	4,521	1,235	18,817	1,051	53.51	25,678
2023	4,540	1,242	18,914	1,056	53.74	25,806
2024	4,562	1,249	19,011	1,061	54.00	25,936
2025	4,583	1,256	19,107	1,066	54.25	26,067

2026	4,604	1,263	19,204	1,071	54.49	26,196
2027	4,624	1,270	19,301	1,076	54.74	26,325
2028	4,645	1,277	19,397	1,080	54.98	26,455
2029	4,664	1,284	19,493	1,085	55.20	26,581
2030	4,681	1,291	19,589	1,089	55.41	26,706
2031	4,698	1,298	19,685	1,093	55.61	26,830
2032	4,714	1,305	19,780	1,096	55.80	26,951
2033	4,729	1,312	19,875	1,100	55.97	27,071
2034	4,742	1,319	19,970	1,103	56.12	27,189
2035	4,753	1,326	20,064	1,106	56.26	27,305
2036	4,762	1,333	20,157	1,108	56.36	27,416
2037	4,771	1,340	20,251	1,110	56.47	27,528
2038	4,779	1,347	20,344	1,111	56.56	27,638
2039	4,786	1,354	20,437	1,113	56.65	27,747
2040	4,792	1,361	20,530	1,115	56.73	27,855
2041	4,798	1,368	20,622	1,116	56.80	27,962
2042	4,803	1,375	20,714	1,117	56.85	28,066
2043	4,807	1,382	20,807	1,118	56.90	28,170
2044	4,811	1,389	20,899	1,119	56.94	28,274
2045	4,815	1,396	20,991	1,120	56.99	28,378

Table M-3. Greenhouse Gas Emissions Forecast Data for Adjusted Business-as-Usual Forecast (2021 California Department of Finance Population Projections)

Year	Residential Energy	Non-Residential Energy	Transportation	Solid Waste	Water and Wastewater	Total Emissions
2018	4,460	1,207	18,436	1,037	52.78	25,193
2019	4,348	1,125	18,182	1,033	52.58	24,741
2020	4,240	1,043	17,928	1,030	52.44	24,294
2021	4,130	961	17,674	1,027	52.28	23,845
2022	4,030	879	17,420	1,027	52.28	23,408
2023	3,934	797	17,165	1,029	52.37	22,978
2024	3,841	715	16,911	1,031	52.49	22,551

2025	3,749	633	16,657	1,034	52.63	22,126
2026	3,728	611	16,403	1,037	52.76	21,831
2027	3,708	588	16,149	1,040	52.90	21,537
2028	3,690	565	15,894	1,043	53.08	21,246
2029	3,666	542	15,640	1,044	53.14	20,946
2030	3,641	520	15,386	1,045	53.19	20,645
2031	3,611	489	15,179	1,048	53.32	20,380
2032	3,577	459	14,972	1,049	53.39	20,111
2033	3,541	428	14,765	1,049	53.41	19,838
2034	3,504	398	14,559	1,050	53.41	19,563
2035	3,465	368	14,352	1,049	53.39	19,287
2036	3,428	337	14,276	1,049	53.41	19,144
2037	3,388	307	14,200	1,048	53.35	18,997
2038	3,347	276	14,125	1,047	53.30	18,849
2039	3,302	246	14,049	1,045	53.16	18,695
2040	3,262	216	13,973	1,044	53.12	18,548
2041	3,214	185	13,897	1,040	52.94	18,390
2042	3,171	155	13,821	1,038	52.85	18,239
2043	3,126	124	13,746	1,036	52.72	18,085
2044	3,084	94	13,670	1,034	52.64	17,935
2045	3,041	64	13,594	1,032	52.54	17,784

Table M-4. Greenhouse Gas Emissions Forecast Data for Adjusted Business-as-Usual Forecast (2018 California Department of Finance Population Projections)

Year	Residential Energy	Non-Residential Energy	Transportation	Solid Waste	Water and Wastewater	Total Emissions
2018	4,460	1,207	18,436	1,037	52.78	25,193
2019	4,367	1,125	18,182	1,040	52.92	24,767
2020	4,277	1,043	17,928	1,043	53.09	24,344
2021	4,188	961	17,674	1,047	53.29	23,924
2022	4,101	879	17,420	1,051	53.51	23,504
2023	4,014	797	17,165	1,056	53.74	23,086

2024	3,928	715	16,911	1,061	54.00	22,669
2025	3,842	633	16,657	1,066	54.25	22,253
2026	3,828	611	16,403	1,071	54.49	21,967
2027	3,814	588	16,149	1,076	54.74	21,681
2028	3,801	565	15,894	1,080	54.98	21,395
2029	3,785	542	15,640	1,085	55.20	21,107
2030	3,769	520	15,386	1,089	55.41	20,819
2031	3,743	489	15,179	1,093	55.61	20,560
2032	3,717	459	14,972	1,096	55.80	20,300
2033	3,689	428	14,765	1,100	55.97	20,039
2034	3,661	398	14,559	1,103	56.12	19,776
2035	3,631	368	14,352	1,106	56.26	19,513
2036	3,599	337	14,276	1,108	56.36	19,377
2037	3,568	307	14,200	1,110	56.47	19,241
2038	3,536	276	14,125	1,111	56.56	19,105
2039	3,504	246	14,049	1,113	56.65	18,968
2040	3,471	216	13,973	1,115	56.73	18,831
2041	3,437	185	13,897	1,116	56.80	18,693
2042	3,403	155	13,821	1,117	56.85	18,553
2043	3,368	124	13,746	1,118	56.90	18,413
2044	3,333	94	13,670	1,119	56.94	18,273
2045	3,299	64	13,594	1,120	56.99	18,133

Appendix N. Growth Rates

Table N-1. Growth Rate Indicators & Sources for Business-as-Usual Forecast

Sector	Indicator	Source
Residential Energy	Population (2018 & 2021 Projections)	California Department of Finance
Non-Residential Energy	Employment	California Employment Development Department
On-Road Transportation	VMT Projections	Calaveras Council of Governments

Off-Road Transportation	Population (2018 & 2021 Projections)	U.S. Census Bureau, American Community Survey
Solid Waste	Population (2018 & 2021 Projections)	California Department of Finance
Water and Wastewater	Population (2018 & 2021 Projections)	California Department of Finance

Table N-2. Growth Rate Indicators & Sources for Adjusted Business-as-Usual Forecast

Sector	Indicator	Source
Residential Energy	Electricity - Renewable Portfolio Standard Other Fuels - Population (2018 & 2021 Projections)	SB 100 California Department of Finance
Non-Residential Energy	Electricity - Renewable Portfolio Standard Other Fuels - Employment	SB 100 California Department of Finance
On-Road Transportation	Emissions Rates (EMFAC 2021)	California Air Resources Board
Off-Road Transportation	Emissions Rates (OFFROAD 2017)	California Air Resources Board
Solid Waste	Population (2018 & 2021 Projections)	California Department of Finance
Water and Wastewater	Population (2018 & 2021 Projections)	California Department of Finance

Table N-3. Population, Employment, and VMT Projections (County Data*)

Year	Population (DOF, 2018)	Population (DOF, 2021)	Employment (CEDD)	VMT Projections (CCOG)
2018	44,692	44,572	57,414	316,278,459
2019	44,808	44,403		
2020	44,953	44,286		
2021	45,126	44,153		
2022	45,308	44,150		
2023	45,507	44,222		
2024	45,721	44,325		
2025	45,934	44,443		
2026	46,142	44,551		
2027	46,349	44,677		
2028	46,557	44,824	60,982	
2029	46,741	44,877		

2030	46,920	44,919	
2031	47,091	45,031	
2032	47,246	45,085	
2033	47,393	45,102	
2034	47,523	45,106	
2035	47,642	45,087	608,147,022
2036	47,725	45,100	
2037	47,816	45,057	
2038	47,896	45,011	
2039	47,969	44,896	
2040	48,033	44,860	
2041	48,093	44,711	
2042	48,135	44,628	
2043	48,177	44,520	
2044	48,215	44,456	
2045	48,256	44,368	

**The above data represents the Calaveras County projections. There was no data available for the City of Angels Camp specifically, so the above data was used to represent the rate of change for the City through 2045.*

Appendix O. Wildfire-related Greenhouse Gas Emissions from Natural Lands Carbon Stock Loss and Climate Change Vulnerability Assessment

Attached as a separate document.